

MARINE REVIEW

VOL. XIX. Published every Thursday at 418-19 Perry-Payne Bldg., by the Marine Review Pub. Co.

CLEVELAND, O., MAY 11, 1899

Entered at Cleveland Postoffice as second class matter.

No. 19

VERY LIGHT STOCKS OF ORE.

ONLY 2,000,000 TONS ON LAKE ERIE DOCKS, AS AGAINST NEARLY DOUBLE THAT AMOUNT IN THE TWO PREVIOUS YEARS—ORE IS BEING CONSUMED AT THE RATE OF 15,000,000 TONS ANNUALLY.

There was barely 2,000,000 tons of iron ore on Lake Erie docks on the first of the present month, as against nearly double that amount on the same date in the two previous years, and the dock figures prove conclusively that the present rate of ore consumption is in excess of most estimates of production for the coming season. Official reports from Lake Erie dock managers, supplemented by conservative estimates as to the consumption of ore that went to the Federal Steel Co. and other interests on Lake Michigan, show that the entire consumption of Lake Superior ores during the year ending with the first of the present month was something in excess of 14,000,000 tons, which figure represents the total production of 1898. The rate of consumption now, which is in excess of all previous records in the history of the industry, is certainly 15,000,000 tons annually, and this with many restrictions attending production in the mining region and with the navigation season nearly a month late in opening.

Reports from all Lake Erie ports to the Marine Review show that stocks on dock May 1 aggregated only 2,073,254 gross tons, against 3,167,915 tons on the same date in 1898 and 3,256,497 tons in 1897. A remarkable feature of this short supply on dock is that it is left over from a production of full 14,000,000 tons in 1898, as against only 12,000,000 tons in round numbers produced in 1897 and less than 10,000,000 tons in 1896. It is reasonable to suppose also that stocks in furnace yards are proportionately reduced, so that the new year starts in with a general cleaning up of supplies. Two million tons on Lake Erie docks is a small item, as much of it is ore that has remained on the docks for years and that would be regarded as almost worthless, except in times like the present. The heavy consumption is best shown by shipments from Lake Erie docks for the full year ended May 1, which aggregated 12,122,982 tons, against 10,209,488 tons during the year ended May 1, 1898, and only 6,719,633 tons during the year ended May 1, 1897. Add to the consumption from Lake Erie docks the ore that has been used at Chicago and other places and the total consumption for the year just at an end would undoubtedly be found to exceed 14,000,000 tons.

At the close of navigation on Dec. 1, 1898, the stocks on Lake Erie docks amounted to 5,136,407 tons. If we deduct from this 2,073,254 tons the amount now on dock, we find that shipments to furnaces from Lake Erie ports during the past winter amounted to 3,063,153 tons, which, added to 9,059,829 tons, the amount shipped to furnaces during the season of navigation in 1898, gives 12,122,982 tons as the entire consumption of ore from Lake Erie docks during the year ending May 1, 1899. The following tables give full details of stocks and shipments to furnaces for several years past:

IRON ORE ON LAKE ERIE DOCKS—GROSS TONS.

PORTS.	Opening of Navigation.			Close of Navigation.		
	May 1, 1899.	May 1, 1898.	May 1, 1897.	Dec. 1, 1898.	Dec. 1, 1897.	Dec. 1, 1896.
Toledo.....	22,915	71,726	66,337	146,568	194,644	115,959
Sandusky.....	7,086	48,800	48,939	48,500	84,786	59,491
Huron.....	82,055	143,170	162,292	139,982	230,029	200,075
Lorain.....	168,646	158,797	180,605	324,034	317,509	231,288
Cleveland.....	472,946	853,776	979,703	1,175,970	1,478,355	1,419,311
Fairport.....	289,417	501,592	480,984	719,794	825,312	773,905
Ashtabula.....	855,691	1,031,441	926,865	1,732,671	1,835,694	1,441,666
Conneaut.....	6,115	69,047	207,034	288,101	360,895	275,800
Erie.....	95,626	236,485	153,261	439,167	484,871	355,222
Buffalo.....	72,757	53,081	50,477	121,620	111,660	82,267
Total.....	2,073,254	3,167,915	3,256,497	5,136,407	5,923,755	4,954,984

IRON ORE ON LAKE ERIE DOCKS, MAY 1 OF EACH YEAR FOR TEN YEARS PAST.

Year.	Gross tons.	Year.	Gross tons.
1899.....	2,073,254	1894.....	2,588,370
1898.....	3,167,915	1893.....	2,095,797
1897.....	3,256,497	1892.....	1,537,188
1896.....	1,949,698	1891.....	2,662,223
1895.....	2,642,890	1890.....	936,228

IRON ORE SHIPMENTS, LAKE ERIE PORTS TO FURNACES, FULL YEARS.

Year ending	Gross tons.	Year ending	Gross tons.
May 1, 1899.....	12,122,982	May 1, 1896.....	8,805,510
May 1, 1898.....	10,209,488	May 1, 1895.....	6,296,215
May 1, 1897.....	6,719,633	May 1, 1894.....	4,870,488

IRON ORE SHIPMENTS, LAKE ERIE PORTS TO FURNACES, DURING WINTER PERIOD, DEC. 1 TO MAY 1.

Winter of	Gross tons.	Winter of	Gross tons.
1898-99.....	3,063,153	1895-96.....	2,466,014
1897-98.....	2,755,840	1894-95.....	2,191,267
1896-97.....	1,698,487	1893-94.....	1,512,340

Bids were opened, a few days ago, by Maj. Henry M. Adams, United States engineer at New York, for a big job of harbor dredging in the Bay Ridge and Red Hook channels. The lowest price, submitted by the Morris & Cummings Dredging Co. of New York, was a fraction over 15 cents per cubic yard. The totals were as follows: American Dredging Co., Philadelphia, \$3,600,000; W. H. Beard Dredging Co., New York, \$4,590,000; R. G. Packard Co., New York, \$6,000,000; W. H. Beard Dredging Co., New York, \$3,015,000; Morris & Cummings Dredging Co., New York, \$2,727,000; Morris & Cummings Dredging Co., \$4,392,000; P. Sanford Ross (Inc.), Jersey City, \$3,150,000.

THE SHIP OWNER HAS HIS TURN.

The individual vessel owner, so-called on account of the drift of ships on the great lakes into the hands of big steel and iron combinations, may have only a few more years of struggle with the management of vessel property, but whether this is so or not he seems to have at least one season before him that will prove highly profitable if he has managed to escape the misfortune of low contracts. Freights are advancing above contract figures almost before the fleet is entirely in motion. The blockade at Buffalo elevators, due to the labor difficulties that have just been settled, was a factor in the upward tendency of the market, but conditions aside from this have worked to the advantage of the ship. The delay in opening navigation has proven far more important in the matter of freights than was expected. On May 1, a year ago, nearly a million tons of freight had been moved to and from Lake Superior while the business of the canal up to May 1 of this year amounted to practically nothing. The Lake Superior fleet is, in fact, only now fairly under way. Added to this comes a summary of stocks of ore on Lake Erie docks, which proves conclusively that not only has last year's output of 14,000,000 gross tons been entirely consumed with a marked reduction of old stocks, but the furnaces and mills using Lake Superior ore are putting it into steel and pig iron at a rate of full 15,000,000 tons annually. This means, of course, that every effort will be strained in the Lake Superior region to get out the last ton that it is possible to produce. And so the vessel owner who has ships free of contracts refuses to accept anything in the way of advance engagements. He has high notions and is not backward about expressing them. For this he is criticized by some of the shippers, who say there is another day coming and he has not long to live anyhow. He answers that he had that day not long ago with 20-cent coal and 50-cent ore on long voyages to and from Lake Superior; that little mercy was shown him and that it is his turn now, even if he has only a year or two to stay in the business. The principal advance is in rates on coal from Lake Erie ports to Lake Michigan, which have gone up to 40 cents, or double the rate in force at this time a year ago.

Some complaint is heard among the vessel owners about a lack of effort in Buffalo to secure the adoption of a coal bill of lading, formulated recently by the Lake Carriers' Association. As far as can be learned, the new form of bill of lading is being generally adopted in the soft coal trade, with no particular objection on the part of the coal shippers. It is stated in fact, that there is absolutely no soft coal being shipped under any bill of lading other than that adopted by the lake carriers.

CARNEGIE REORGANIZATION.

The reorganization of the Carnegie Steel Co., so as to take in all of its collateral and auxiliary interests, including the Frick Coke Co., Oliver Mining Co. and Pittsburg, Bessemer & Lake Erie Railroad, overshadows all other undertakings in industrial lines that have startled the country of late, but as might have been expected from the vague and uncertain tone of dispatches that filled the daily newspapers during two weeks past, is now fully understood that there is absolutely no foundation for the stories of a billion dollar combination, to include the Federal Steel Co., American Steel & Wire and other big organizations. It would not be surprising to learn, after the reorganization of the Carnegie interests is effected, that men now in control of the National Steel Co., will also be represented in the new consolidation. This lends interest to the probability of the National company being eventually absorbed, and it is also thought that the so-called Rockefeller party may have considerable to do with the financing of the new organization, which might lead to Rockefeller mines and ships being included instead of operating as they are now under leases and contracts. But speculation on this score is simply prompted by the fact that leaders in the National Steel and Rockefeller companies are closer and more in harmony with the Carnegie interests than the Federal Steel Co. or American Steel & Wire, which have probably taken no part whatever in the present negotiations.

As nothing official has as yet been given out regarding capital of the reorganized Carnegie company, or the price to be paid to Mr. Carnegie upon his retirement, the figures quoted from New York and Pittsburg are regarded as entirely speculative. It is more than probable, however, that the capital will be greater than that of any industrial as yet heard of in this country, as the Oliver Mining Co. controls Lake Superior properties capable of producing 4,000,000 gross tons of iron ore annually, while the Frick company has practically a monopoly of the coke industry, and the scope of the Carnegie mills and furnaces is greater than that of any similar institution in the world.

Arthur H. Hawgood and others of Cleveland have contracted with the Craig Ship Building Co. of Toledo for a steel steamer of Welland canal size, to be finished about Nov. 1. The Craig company is just completing for Miller, Bull & Knowlton of New York a steamer of Welland canal size and they have another under way for the same firm, both of which will go to the Atlantic coast immediately upon completion. The steamer just contracted for will also be fitted for salt water service, but will probably not go down to the coast until the spring of 1900 when it is expected the St. Lawrence canals will be completed, and when another similar vessel, now nearing completion at Lorain for W. A. Hawgood, brother of Arthur Hawgood, will also leave the lakes. The steamer building at Lorain will be launched Saturday and will be christened Eureka, which is also the name of the transportation company that owns her.

Admiral Farragut's famous flagship, the Hartford, which has recently been refitted, has been assigned by the navy department to the service of training naval apprentices on the Pacific coast.

EVOLUTION OF THE STEEL SHIP.

A MAGNIFICENT CREATION OF LESS THAN HALF A CENTURY OF HUMAN SKILL AND INDUSTRY—SPLENDID EXAMPLE OF MAN'S TRIUMPH OVER THE FORCES OF NATURE.

BY JOHN B. ROACH.

In the twenty-seven years I've been ship building on the Delaware, the first steel warship, the first iron sailing ship, and the first steel steamship in the United States have been built in our yards, and the first compound marine engine ever erected in this country was also constructed here. It seems hard to realize that such a thing as a steel ship was unknown a quarter of a century ago; whereas wooden ships plated with iron were attempted as long ago as 1585, by the Dutch when they built the *Finis Belli* in the river Scheldt, hoping to annihilate the Spaniards.

The *Dolphin*, the first steel warship the United States ever owned, was also the first steel propeller built in this country. Yet the *Dolphin*—now in admirable trim—although she made a single voyage of 53,000 miles, the longest on record, without an hour's delay for repairs of any kind, was not even authorized by Congress until March 18, 1883, but little over sixteen years ago. It is owing to our mastery of steel-working in the past twenty years that the steel ship is now the accepted type of all marine architecture. The practical differences between the iron plates in use on ships for many years previous, and the steel plates now universally adopted, are so vital as to be understood even by a non-expert. Yet there are doubtless few, save those who have made the subject a special study since boyhood, with abundant opportunities of working out practical problems, who realize the romance in the history of the metal ship. There is no more splendid example of man's triumph over the forces of nature. The idea of an iron ship, a structure requiring the greatest buoyancy, made out of metal of the greatest gravity, would have been considered by the ancients a contradiction in terms. Yet they were fine workers in metals and very successful ship builders after their own ideas.

When the Dutch conceived the idea of building a floating wooden fortress and then plating it over with iron, they made a brilliant but unsuccessful start in the right direction. The *Finis Belli* had no steam to move her, and became unmanageable. By and by there was a steam warship built, the *Fulton*, or *Demologos*, in 1814, but she had no iron plates, and her deck was sheathed with nothing more formidable than heavy scantling. Yet the idea of sheathing was still in evidence. When Ericsson invented the propeller in 1837, it was inevitable that there would be a screw warship, and the *Princeton* was launched in 1839. Then, in 1842, John Stevens built his floating fort, sheathed it with iron, and put heavy guns aboard, going back to the idea of the Dutch, but nothing practical came of it.

STEEL SHIP BUILDING STIMULATED BY THE CIVIL WAR.

The civil war naturally stimulated ship building to renewed activity. John Roach, my father, had already one of the best equipped foundries and engine works in the country. I can speak from my own knowledge, for I had served my apprenticeship under him in the Aetna Iron Works and later in the Morgan Iron Works, and as a boy, even, had carried his dinner basket to him when he was a workman in the old Allaire works in New York, all of which he afterward owned. When he purchased what has since been Roach's ship yard at Chester, Pa., in 1871, I took an executive position there, and since his death in 1887 have had charge of the works. In the sixties, in this yard, there had been built for the United States government the monitors *Lehigh*, *Sangamon* and *Junxis*, at least one of which was again made ready for harbor defense last summer, when it was feared that Cervera's mysterious fleet was about to attack our coast. It is of more value in the evolution of the modern steel ship that the *Wateree*, the first iron gunboat, had been built in this yard in 1863. While this was going on along the Delaware my father had built engines in New York for the great sound steamers, *Bristol* and *Providence*, for the iron ram *Dunderberg*, built by Webb for our government, but not finished in war time, and afterwards sold to the French, who rechristened her the *Rochambeau*. The engagement in Hampton Roads between Ericsson's *Monitor* and the *Merrimac* had not only drawn the attention of France and other foreign governments to the improvements made in iron warships in the United States, but resulted also in our government ordering the construction of the iron *Canonicus* and *Mahopac*, and the other "ninety-day boats."

It was now evident that the ironclad was the warship of the future. France, indeed, in 1854, had built the monitor *Devastation* and the *Gloire* in 1858, while Great Britain had in 1859 authorized the building of the ironclad *Warrior*. But nobody knew what an ironclad was good for until Ericsson's monitor demonstrated it. The razed wooden steamships which the Confederates protected with railroad iron and chains, on the southern rivers, gave American genius another strong hint. But when the war came to an end but little more had been accomplished. The monitors then building were gradually finished, and no new ironclads were ordered until 1874. In that year we built for the government the *Alert* and the *Huron*, the first iron sloops of war ever constructed. They were of 1,246 net tons. Another step forward followed quickly when the contracts for the great double-turreted monitors, *Miantonomoh* of 2,025 tons, and *Puritan* of 2,898 tons, were awarded us in '76. These vessels, each a pioneer on its own lines, grew under my very eyes, and their great hulls and engines are as familiar to me as the rooms in my own home. For though born in Monroe street in New York, while my father was still working at his trade as an iron molder, I have since 1871 devoted my entire time to the ship yards in Chester. Since the day when I went into the Aetna Iron Works, in Goerck street between Rivington and Stanton, at the age of eighteen, ship building had been my study, my ambition, my life work. I was proud of the yard which, before we secured it in '71, had turned out in '63 the sister ships *Wateree*, *Shamokin* and *Suwanee*, all double-ended side-wheel iron gunboats. When a tidal wave picked up the *Wateree* out of the harbor of Callao in Peru, and carried her inland, miles from the ocean, to spend her last years as a summer hotel, I felt a sense of personal grievance. But I foresaw that

all which had been done in the way of metal warships would soon be distanced.

THE DOLPHIN, FIRST STEEL WAR SHIP.

In March, '83, congress authorized our first steel warships, the dispatch boat *Dolphin*, of 1,202 net tons, and the protected cruisers *Boston* and *Atlanta* of 2,296 tons, and the *Chicago* of 3,507. The contracts for their construction were awarded to John Roach, the lowest bidder. The building of a warship of steel—a metal then so little known in practical working—was a task that might well tempt the most ardent ambition. But already in December, '82, we had taken a contract, fraught with almost equal possibilities, for the construction of the first metal sailing ship built in the United States and one of the very first in the world. This was the *Tillie E. Starbuck*, a full-rigged iron ship, launched April 4, 1883. The *Starbuck* went into commission June 12, 1883, and she is today trading around the world, one of the most picturesque and profitable vessels of her class in existence, sailing from New York to San Francisco and from San Francisco to Calcutta as readily as though steam had never been discovered. She was built for William H. Starbuck of New York, and named by him after his wife, Miss Tillie E. Irving a Chester girl. This vessel was of 2,038 tons, cost \$150,000, which was considered a great deal of money to put into a sailing ship, was 273 feet long, 42.3 feet beam, 26.3 feet depth of hold, and 175 feet from her main truck to the water. She was the first sailing vessel in the world to carry metal masts, hers being of 3/8-inch iron plates.

But the *Starbuck's* superiority to many tramp steamers did not depend entirely on her speed. In building this vessel interesting new problems had presented themselves. Comparing a wooden ship with an iron ship, the original cost of the latter would be, say, 60 per cent more than that of the former. But the wooden ship would have to be practically rebuilt in fifteen years, while the cost of maintaining the iron ship for the period would be ordinarily less than 10 per cent of the original cost. The seaworthiness of the iron sailing ship was splendidly shown by the behavior of the *Starbuck* in a terrific gale around the Falkland islands; her iron masts, which were purely experimental, neither broke nor strained, although she went through a test which proved fatal to many wooden vessels of the highest class which happened to be in the southern seas at that time.

EARLY STEEL MERCHANT VESSELS.

The *Starbuck* was an iron ship. The first steel side-wheel merchant steamer in the United States was the *Alaskan*, launched in the Roach yards in '83 for the Oregon Railway & Navigation Co. Her length over all was 288.4 feet, her beam 36.6, and her depth 15.3. It was from the successful achievement of tasks like these that we turned to the construction of the *Dolphin*. And it was only fitting that these great departures in this most ancient of trades, now become an art as well as a science, should be made on the Delaware river. On that stream ship building had recorded other notable achievements before my day. John Mills, our boat yard foreman, who had charge as foreman of the *Starbuck*, occupied the same relation to the *Dolphin*. While he was learning the trade at Wilmington in 1852, forty-seven years ago, an iron steamboat of 350 tons was successfully launched from the ship yards of Harlan & Hollingsworth, still one of the best known plants in the country. That very steamer, built of boiler iron, and ironically called a tin boat by the wooden ship builders of that day, who alleged that she would break in two if she should strand on a bar, is still in actual service, running from Philadelphia to Salem, N. J. She is, of course, a side-wheeler of low freeboard, called after her first owner, Major Reybold, and I can see her daily from my office windows plying her way along the very stream into which she was first launched almost a half century ago.

The inaccuracy of the charge of "structural weakness" made by a partisan examining board against the *Dolphin*, which was launched April 12, 1884, was made apparent in more ways than one. No ship ever made without repairs such a voyage as the *Dolphin's* famous cruise around the world. She is now in actual service, as is the *Boston*, which was in Dewey's gallant fleet in the battle of Manila bay, and is still in the Asiatic station dealing with the recalcitrant Filipinos. The *Dolphin* is like the *Boston*, a remarkably interesting type.

Nowadays we use by preference open-hearth steel for our ships. We can weld steel as easily as iron, and work it cold, bending it as iron never would bend. If not bent at right angles to the grain, iron splits like a board, whereas steel has no grain. But in those early days, the days of experiment, we knew comparatively little about working steel. The substitution even of angles of iron for straight iron beams, to which the outer plates were to be riveted, was then of comparatively recent date. The angles fit into the keel or backbone of the ship, the plates are riveted to the angles, and the result is a marvel of strength, as far superior to the straight beams used before as an iron ship was to a wooden ship. Yet the very first angle frame put up on the Delaware was in 1854. And so the magnificent steel ship of 1899, with her internal machines numbered by the score, and adapted to all the varying uses of her complement of hundreds of men, a thing of beauty and utility perfectly conjoined, is the creation of less than a half century of human skill and industry, perseverance and daring.

The steamer *Kaiser Friedrich* arrived in New York recently with her engines thoroughly overhauled and equipped with independent air pumps of the Blake vertical twin system. Blake twin air pumps on the steamer *Kaiser Wilhelm der Grosse* of the same line were so satisfactory that the North German Lloyd company decided to replace the connected air pumps of the *Kaiser Friedrich* with this system. The 34,000 indicated horse power express steamer *Deutschland* building for the Hamburg-American company, as well as the two new French liners, *La Lorraine* and *La Savoie*, are to be equipped with Blake twin air pumps, together with a complete outfit of feed, fire, bilge and sanitary pumps.

Mr. Edward Chapman of the Merritt-Chapman Wrecking Co. is accredited with being the promotor of the project for the formation of a towboat combination in New York. The capitalization suggested is \$500,000. Options have been secured on a large number of towboats.

CANADIAN IRON ORE DEPOSITS.

Discussion of a possible shortage of iron ore, comprising the ranges of Michigan, Wisconsin and Minnesota, referred to in the Review last week, has served to direct attention to the iron ore deposits of the province of Ontario in Canada, and especially to those of the Rainy River district, the extent and value of which are of late said to be much greater than had generally been supposed. An effort is now being made to secure additional aid from the Canadian government for the Ontario & Rainy River road. The movement is meeting with fair prospect of success, because of the unanimity with which all persons who have explored the country agree that it is rich in high-grade ore. The possibility of depreciation in the value of the Minnesota ore lands, and the possible exhaustion of ore beds that were said to contain unlimited supplies, is, of course, being used as the basis for argument favorable to the request of the projectors of the Canadian road for a double subsidy of \$6,400 per mile. Blast furnace projects at Toronto, Owen Sound and Midland have been planned with reference to the assistance that would be afforded should the Rainy River line develop into a great ore road. In this connection it is also noted that promoters of the blast furnace at Owen Sound are seeking a modification of the Canadian bounty law, which at present provides \$3 a ton on all pig iron produced from Canadian ore and \$2 a ton on imported ores. They want bounty paid only on the product of domestic ore, but the scheme will, of course, be opposed and in all probability killed by the Nova Scotia Steel Co. and the Dominion Steel & Iron Co., which import their ore from Newfoundland, and by the Hamilton Blast Furnace Co. and the Deseronto Iron Co., which are supplied with ore from the Lake Superior district.

MAY STORMS ON THE GREAT LAKES.

In discussing weather probabilities for the great lakes during the ensuing month, Mr. Alfred J. Henry, writing for the United States weather bureau chart, says:

"The number of storms that pass across the lake region in May is slightly less than in the preceding month, and the average track is somewhat farther north, both conditions becoming more marked as the warm season advances. The average or principal storm track, as indicated on the chart, shows merely that the centers of May storms on the average of many years move in the general direction indicated. Storms following the average course are not, as a rule, especially dangerous. When, however, a disturbance pursues an unusual course for the season, severe weather generally follows. Thus, a storm moving easterly over northern Illinois, would not be following an unusual course for the winter months, but such a storm occurring in May would give unseasonable weather with high northeasterly backing to northerly gales over Lake Michigan. The prevailing winds in May at stations on the upper lakes are from a northerly quarter, while at points on the lower lakes the general direction is westerly or southwesterly. The highest winds are about evenly divided between southeast and southwest. In front, or to the east of an advancing storm, southeasterly or southerly winds prevail, and from this fact alone the inference may be drawn that the storm center will pass to the north of the observer. The importance of this inference will be apparent when it is remembered that the hardest blow almost invariably occurs with the shift of the wind to the southwest or northwest, as the storm center passes the vessel. Whether the wind shifts from southeast to southwest, or backs from northeast to northwest, depends then upon the position of the vessel with regard to the storm center."

TRAINING SHIP FOR CHICAGO.

There is a strong probability that the transfer of the auxiliary yacht Frolic to the naval reserve organization of Chicago will be delayed and possibly prevented for the time being by complications with the Canadian government which have not been adjusted with the facility anticipated by officials of the navy department. The Frolic, which was built by the Globe Iron Works Co., Cleveland, was formerly known as the Comanche, and was sold to the government by H. M. Hanna during the Spanish-American war. Later when it was discovered that the draught of the auxiliary yacht Wasp, which had been assigned to the Chicago naval reserves as a training ship, was too great to permit of her passage through the canals, the Frolic was substituted for the service mentioned. Some weeks ago Governor Tanner wrote to the navy department urging that the vessel be sent to Chicago as early as possible, and has received a reply from Assistant Secretary of the Navy Allen in which that official says that he is informed by the secretary of state that the Canadian government has not yet waived the objection which it some time ago raised to the transfer of the vessel on the basis of the provisions of the Rush-Bagot treaty. The secretary of state says that he had hoped the whole matter would have been adjusted ere this, but as it has not been "it is not considered expedient to do anything at present which will seem a violation of our international obligations in the matter."

SHIP BUILDING PROFITS IN GERMANY.

The German ship building industry, owing to the numerous new steamers ordered, has been profitably employed during the past year, and the statements of the principal companies recently published, with one exception, show favorable results. The Vulcan works at Bremen, which for a long term of years has made a uniformly good showing, was able to pay its stockholders a 12 per cent dividend, instead of 10 per cent as in 1897. The Howaldts Ship Building Co. at Kiel paid 7 per cent dividend, the same as in the previous year, carrying besides a very considerable sum to its reserve fund. The great Neptune Ship Building & Machine Manufacturing Co. at Rostock, which has never heretofore been able to pay a dividend, now announces that it will pay its shareholders 4 per cent. On the other hand, the Seebeck Ship Building & Drydock Co. at Geestemuende-Bremerhaven, after years of prosperity, makes quite an unfavorable showing, its balance on the loss side being the considerable sum of 322,224 marks (\$76,689). The special reasons for the loss are not published. In 1897, as well as in 1896, it paid dividends of 7½ per cent to its stockholders.

THE NAVY AS A PROFESSION.

Capt. Robley D. Evans, U. S. N., familiarly known as "Fighting Bob," is the author of an article dealing with the navy as a profession, which appears in the current issue of the Saturday Evening Post. Referring to disadvantages to be considered by the young man who contemplates entering the service, Capt. Evans says:

"Of the disadvantages of the navy as a profession little can be said unless money-getting be considered as important. By money-getting I mean the accumulation of money beyond the necessities of life. To the man who has this in view the navy offers no place. The pay is sufficient to keep one from want, but nothing more. The only real disadvantages of the navy as a profession are the enforced absence of the officer from his home and family while his children are growing and being educated, and his inability to make for himself a home. These are real, and must be seriously considered before the final decision is reached. One other serious disadvantage should be mentioned, and that is the life of exposure and hardship—sleepless nights of anxiety are the rule after a certain rank is attained, and through all ranks the exposure to wind and weather, heat and cold, is common. But these have their counterparts in all walks of life where men lead real lives."

"Of actual hardship there is plenty, but this tends to make real men of those who choose the navy as a profession. To stay on the bridge for thirty-six hours in a howling gale is a real hardship, but it is part of a captain's duty, and must be done. To stand at quarters during half a night in the tropics is a hardship after the excitement of the first half-dozen nights, but it is part of the contract, and must be met. To stand on the forecandle of a battleship all night, with the sea breaking 10 feet over your head every few minutes, while the 13-inch guns swing from side to side, is surely a hardship; but every man is the better for it, and feels a justifiable pride when the 500 tons of turret and guns have been mastered and secured so that they can do no further harm. Naval life is full of hardships, but naval men show the benefit of having stood those hardships. Every battle with the elements leaves its mark for good on the men who come, successful, out of it."

A PACIFIC COAST STEAMER.

Plans prepared for the steamer "1900," as it is thus far known, which is to be built, probably at some Pacific coast ship yard, for the Alaska Packers' Association of San Francisco, evidences the fact that President Henry F. Fortmann intends to fulfil his promise to secure for his company a vessel that shall be thoroughly modern and efficient in every particular. Indeed it is Mr. Fortmann's especial desire to replace with ocean-going steamers the fleet of sailing vessels and small steamers now in the service of his company on the Pacific. Plans for the hull and machinery of the new steamer were prepared by W. P. Lindley and Thomas Ransom. The vessel will be 217 feet over all, 35 feet beam and 18 feet deep with a displacement of 2,100 tons. She will have a cellular double bottom with six watertight compartments, and the main hatches are to be of ample size to facilitate the handling of timber and heavy packages. The lower hold is to be 108 feet in the clear and especially fitted for the carrying of salmon, the expectation being that a cargo will comprise at least 33,000 cases.

The steamer will be fitted with triple expansion engines with cylinders of 9, 15½ and 27 inches diameter and a common stroke of 24 inches. There will be piston valves in the high and intermediate cylinders and a double-ported slide in the lower, all being worked by the Stevenson valve gear. The crank shaft will be of the built-up type, 6 inches in diameter, and an evaporator and auxiliary condenser as well as steam reversing engine will be provided. The engines will develop about 750 horse power and are expected to drive the vessel at an average speed of 10 knots. Steam will be supplied from Babcock & Wilcox water tube boilers, with a working pressure of 225 pounds and a heating surface of 3,000 square feet. The steamer will have accommodations for twenty-six cabin and an equal number of steerage passengers and many of the state rooms will be fitted with baths. The equipment will include steam steering gear, steam towing machine and steam capstan, with an electric lighting plant and electric search light.

DRY DOCK FOR CUBA.

Andrew Gunderson, who has been engaged for more than fifteen years past as chief draughtsman for John N. Robins at the Erie basin, New York, has gone to Cuba where he expects to take up a permanent residence and to give personal supervision to several enterprises of some magnitude undertaken by Krajewski, Pesant & Co. of 32 and 34 Broadway, Manhattan, proprietors of the Erie basin iron works. The firm has large holdings of property at Regia, directly across the bay from Havana, which has the advantage of being the terminal of the united railroads, and here operations have already been commenced. One of the first works to be undertaken under the direction of Mr. Gunderson will be the construction of a floating dry dock with a metal sheathed bottom, 220 feet long and 90 feet wide on the floor. In addition to the dry dock, plans have been drawn for a pier 276 feet in length at Regia, at which ships of the greatest draught will be enabled to discharge cargo. The construction of modern machine and boiler shops, electrical works and brass and iron foundries will follow in a short space of time.

Charts of all kinds are sold by the Marine Review Pub. Co., Cleveland, but a few new ones are recommended particularly just now. All are engineer charts. One covers Lake Michigan in a single sheet, and the others covering the St. Mary's river, are made from a general resurvey of that busy waterway.

The Babcock & Wilcox Co. of New York has received a \$20,000 order for two 500 horse power water tube boilers for use on the Caroline sugar plantation near Cienfuegos, Cuba. Several smaller boilers to be furnished for industrial plants in Mexico aggregate in value \$11,450.

NATIONAL PUBLIC WORKS.

CRITICISM OF THE POLICY THAT HAS KEPT THE EXPENDITURE OF MILLIONS OF PUBLIC FUNDS ENTIRELY UNDER CONTROL OF THE ARMY ENGINEER CORPS
—A HISTORY OF THE ARMY CORPS AND ITS WORK, AND THE STRUGGLE OF THE CIVIL ENGINEER FOR RECOGNITION.

BY GEO. Y. WISNER.*

In April, 1888, a number of distinguished civil engineers, representing twenty-three engineering societies, having a constituency of over three thousand practicing engineers, had a hearing before the United States Senate Committee on Commerce, relative to changes in methods of conducting public works, and, in reply to the statements presented, the chairman of the committee said: "If a worse system than ours can be found on the face of the earth I would like to know it." In view of the fact that strong recommendations have recently been made to have the number of engineer graduates from West Point largely increased, so that an officer of the engineer corps can be placed permanently in charge of each river and harbor project, it will be of interest to know whether the statement of the distinguished senator was true in 1888, and, if so, whether the system of conducting the public works of the country has so improved since that date as to warrant the placing of all important government engineering projects under the control of graduates of West Point and to exclude all civil engineers from holding any positions on such works except those of a subordinate nature. If the system is worthy of being perpetuated, a fair discussion of its history and merits will give it a higher standing with public men, and if not worthy, a thorough discussion is certainly desirable.

Previous to the present year the tendency of national progress in this country has been almost entirely along commercial lines, while our system of public works has gradually passed from civil to military control, a condition of affairs which, when compared with the systems of public works of European countries, seems somewhat anomalous. The continental systems are strictly under civil control, and are so constituted as to secure to the government the services of civil engineers eminent for their ability and practical experience; and have resulted in the development of men of great theoretical and practical attainments, whose works and writings are the basis of plans of many important public works in this country. In Great Britain no government public works organization has ever existed, and with the exception of dock yards and harbors of refuge, all river and harbor improvement works are under the control of boards or trusts, who go into the open market and secure the services of any civil engineers they may choose to select. The system is one which insures the quick completion of work when once inaugurated, prevents the starting of projects of doubtful utility and completely eliminates all danger of the "log-rolling" methods which have become one of the necessary evils connected with the passage of a river and harbor bill by congress. The public works organizations of other European countries are practically similar to those of France and Prussia, which are independent departments of the government, under the direction of the minister of public works.

Naturally the method of making public improvements in the early days of our republic were those inherited from the mother country, but the limited means at the disposal of corporations and municipalities, and the immense distance over which transportation facilities were required, soon made it necessary to resort to other sources for funds with which to carry on such enterprises. Aside from the military academy at West Point, the first engineering school in the United States was established at Troy, N. Y., in 1824, and consequently the source of supply of civil engineers for either public or private work was limited to the West Point graduates and to men who had obtained some experience in engineering as assistants on the few public works then under construction. The decision of the United States courts at an early date limited state control over navigable waters, and practically settled for the future that the system of public works must be a governmental one, not necessarily military; and as the military academy at West Point was the only source at that time from which educated engineers could be obtained to take charge of engineering projects, it is not strange that all governmental improvements should have been executed under the direction of the military engineers.

The corps of engineers owes its origin to an act of congress of March 16, 1802, by which the president was authorized to organize and establish at West Point a corps of engineers not exceeding twenty in number, which was to constitute a military academy, and to be subject at all times to do duty in such places and on such service as the president of the United States should direct. In 1838 the corps was increased to a total of forty-seven officers, and at the same time a corps of topographical engineers of about the same number was organized. There was but little harmony in the working of these two organizations, and in 1863 the corps of topographical engineers was abolished and its officers merged into the corps of engineers, the number of officers for which was fixed in 1866 as follows: One chief of engineers, six colonels, twelve lieutenant-colonels, twenty-four majors, thirty captains, twenty-six first and ten second lieutenants. This organization was charged with all duties relating to the selection, purchase and survey of sites, and the plan, construction and repair of all fortifications; with all channel and river obstruction for the purpose of defense; with all fixed and movable bridges for the crossing of navigable waterways; with all surveys, plans and construction of harbor and river improvements, and with military and geographical explorations and reconnaissances as might be required for these objects, including the geodetic survey of the great lakes. For twenty-two years after the establishment of this corps the West Point academy was the only institution in the United States making any pretense at having a course in civil engineering, and it was but natural that the younger graduates of that institution should have regarded themselves as the only ones qualified to discuss problems pertaining to their profession, which opinion, as an inheritance to the graduates of that institution during later years, has probably been the indirect cause of many of their troubles.

In 1843 Prof. Alexander D. Bache, who graduated from West Point in 1825 and soon afterwards resigned from the corps, and from ability and experience having become one of the foremost scientists of the country,

was appointed superintendent of the United States coast survey. Prof. Bache was one of the best executive and scientific men of modern times, and congress, impressed with the businesslike methods with which he directed the work assigned to his charge, granted liberal appropriations for its prosecution, with which results of great value to navigation were obtained and a national reputation established for the department. In connection with the topographical and hydrographical survey of our coast lines an accurate geodetic survey was inaugurated, which has since developed into a system of triangulation along the entire Atlantic coast and connecting across the continent to the Pacific ocean. The authority granted to the engineer corps to make geographical explorations and geodetic surveys soon brought on a conflict with the coast survey, which was a discredit to both organizations, and undoubtedly was one of the principal causes for the distrust with which the methods of conducting our national public works are regarded. Thousands of dollars were wasted in the duplication of surveys and in the execution of work which has never been utilized, and for doing which there was no apparent reason other than to get ahead of the other department. The fact that the superintendent of the coast survey was a graduate of West Point naturally gave rise to the expectation that the organizations would work in harmony, but such was far from being the case; and in this connection it is of interest to note that a bitter feeling of antagonism exists in the corps at the present time towards ex-members of that body who have resigned to engage in the private practice of their profession.

With the rapid growth of our country since 1865, and the necessity of securing the best engineering talent available for public works, a general disposition among thoughtful men arose to protest against establishing military supremacy in matters of a purely scientific and civil nature. It was evident that to place our entire national improvements under the control of a close corporation, the members of which were culled from the graduates of a single institution and governed by military rules which prohibited advanced ideas on the part of subordinates, would not be to the best interest of the commercial and other enterprises depending for success on the rapid and economical completion of extensive river and harbor improvements. The differences of opinion relative to the methods which should be adopted for the improvement of certain rivers and harbors culminated, in January 1874, in a proposition from Capt. James B. Eads to improve the entrance to the Mississippi river for a fixed amount of money, the government not to be liable for any part of the cost of the improvement unless the results specified should be obtained. A few months later congress authorized the president to appoint a commission, consisting of three military engineers, three civil engineers and one member of the coast survey, to visit the harbors of Europe and report upon the question of the best method of making a deep water entrance to the Mississippi river. This commission decided in favor of the jetty system advocated by Capt. Eads, and which he afterwards carried out with such success as to give him a world-wide reputation as one of the ablest hydraulic engineers of the century. If the petty jealousies of some of the older members of the engineer corps had not been the controlling element with that body the organization might have secured much of the credit for the success of the enterprise, and at the same time have advanced their professional standing by securing the cordial co-operation of the civil engineers of the country. Instead of this a bitter antagonism to the enterprise was engendered, which resulted in large financial loss to the contracting engineer and damaged reputations for his opponents. The time never existed when the civil engineers were not willing to cordially co-operate with the army corps, provided they could do so on an equal footing. This right was not admitted, and a struggle for professional recognition by the civil engineers and to prevent loss of control of public works by the army corps has been continued in various ways ever since. While it is to be regretted that so much engineering talent should waste its energies in professional quarrels, certain compensating benefits have resulted, due to the careful studies the advocates of either side have been obliged to give to the plans, methods and projects proposed by their opponents.

The complete failure in 1883 of the plans of the engineer corps for improving the entrance to Galveston harbor resulted in an invitation being extended by the people of Texas, through their legislature, to Capt. Eads to submit a proposition for securing a 30-foot entrance to the harbor for a lump sum, payable when results were obtained. Capt. Eads complied with this request, and a bill was introduced in congress authorizing the government to enter into such a contract, but owing to false representations on the part of the corps to the effect that the government could complete the improvement for one-tenth of the amount which it was proposed to pay Capt. Eads, the bill was defeated. The work since done on this project has cost nearly as much as was asked by Capt. Eads to complete the improvement, and has resulted in securing a narrow channel about 26 feet deep.

With the successful completion of jetty works at the mouth of the Mississippi river, and the general impression that any project for public improvements having its origin outside of the army corps would meet with bitter opposition from that body, many prominent civil engineers were convinced that the good of public service demanded that the entire system should be remodeled, and that civil engineers in such service should be on an equal footing with military engineers as to the control and execution of work under their charge. At the convention of the American Society of Civil Engineers in St. Louis in 1880 a resolution was adopted to appoint a committee to draft a memorial to congress asking that the civil engineers of the country should be placed in full charge of improvement works carried on by the government. The influx of military engineers into the society during the next year was somewhat abnormal, and at the next annual convention the committee reported against the contemplated action on the grounds that it would be prejudicial to the interest of some of the members of the society. A memorial to congress was, however, circulated privately, to which the signatures of 168 engineers were secured, of which sixty were prominent members of the American society. This was probably pigeonholed and possibly never read in congress, but the agitation resulted in an invitation being issued by the Civil Engineers' Club of Cleveland to the various engineering societies of the United States to meet in convention at Cleveland, Dec. 3, 1885.

Ten different societies sent delegates to the convention, and after formulating a line of action and electing a permanent executive board, they

* Paper read at a recent meeting of the Detroit Engineering Society.

adjourned until March 31, 1886, when a permanent organization of delegates from twenty-three societies was effected under the title of "Council of Engineering Societies on National Public Works." A memorial was addressed and presented to the president of the United States, outlining a system by which it was proposed to secure the "adoption and execution of only those projects that are necessary and useful to commerce; the correctness of plans and economy and effectiveness in their execution, and to avoid the wastefulness of public funds in legislation and administration."

After two years of study and discussion the Council of Engineering Societies formulated their conclusions into a bill, which was introduced in both houses of congress Jan. 16, 1888. This bill was carefully considered by the committees of both houses of congress and favorably reported, but finally died a natural death before being reached on the calendar. Under this bill the military engineers would have had a majority of the officers in the new corps, and no doubt would have controlled its methods to a considerable extent; and as these officers would have been in direct competition with some of the ablest civil engineers of the country the efficiency of the organization of the corps would have been greatly increased. This bill would have become a law but for the lack of support from the technical press, which for reasons best known to the editors of those journals, did not at any time view the movement with favor. The discussion of this bill resulted in some changes in the methods of conducting public works which were of much benefit to the service, but so far as the military and civil branches of the profession were concerned, the relations were by no means improved. District officers in charge of important enterprises were ordered to give out no information relative to the condition of the works, and to put nothing in their annual reports which could be utilized by civil engineers for the purpose of criticising their methods and plans. This was carried so far that in one case an assistant engineer who had sufficient self-respect to report the actual condition of the works under his charge was immediately discharged.

The demand for deep water ports on the gulf coast was such that several private companies undertook to raise funds by floating bonds with which to execute the work, but were unable to do so owing to the adverse criticism of the projects and plans by the corps. Two of these projects were so near completion before their projectors were obliged to abandon them for want of funds that the results obtained showed conclusively that the completion of the plans would have produced better depth of channel than predicted by the engineers in charge, and yet both of these enterprises have recently been reported on by boards of army engineers as being of no value to the government, in spite of the fact that vast sums of money were spent under direction of the corps at both of these places before being abandoned by the government.

One of the worst features of the system is the method of handling the funds appropriated for carrying on national improvements. The clerical work necessary under the regulations is at least five times that which would be used by a good business concern in doing the same amount of business, and at the same time does not in any way protect the government or the public from fraud. It is true that the army officers are not directly responsible for the regulations under which their accounts are audited, but it is equally true that by making no protest at the wasteful and unbusinesslike methods required on government engineering, they become partners in the transaction. The expediency and amount of an expenditure is of little moment compared with the form of the receipt and the color of the ink used. The system is a direct bid for fraud on the part of chief clerks, who become so accustomed to doctoring the form of bills and vouchers for the purpose of having them pass the treasury auditors that they sometimes forget where to stop. In addition to the expensive and cumbersome office methods necessitated by the system, the engineers in the field are obliged to devote a large amount of valuable time to the supervision of making out and certifying unnecessary bills and receipts. Probably one of the greatest drawbacks to the success of military supervision on civil work is that military etiquette prohibits all criticism of opinions and plans of ranking officers by subordinates, and it is not at all improbable that the evil effects of this restriction may eventually be the cause of disrupting the corps.

Civil engineer employes of the engineer corps have been placed under the control of the civil service commission. There is no doubt that so far as clerkships in the postoffice and other departments are concerned, the protection afforded by the civil service act of 1883 has been of great benefit to that vast army of officials and also to the government service, but since in engineering matters success depends largely on the principle of "survival of the fittest" the restriction of the civil service rules in regard to the selection and appointment of men qualified to best do the work required and to discharge assistants when found inefficient, together with the tendency to destroy ambition, cannot be otherwise than detrimental to the service. The very fact that a man knows that his tenure of office or promotion does not depend upon the amount or quality of the service he renders often makes him inefficient. Engineers like to take the world easy as well as men of other professions, and when this can be done without detriment to position it is likely to occur. The engineer service has never been subject to the abuses arising from political appointments, which gave rise to the civil service act, and consequently there was no excuse for placing the employes under its regulations. The engineer corps are entitled to much credit for having at all times resisted every attempt to subject the department to the spoils system, and having demonstrated their ability to do this, it seems strange that they should have allowed the organization to be loaded down with unnecessary and cumbersome methods. It is just as easy to formulate rules to prevent all undue political influence in the management of public works as to make the positions of field and office engineers independent of the officer directly responsible for the success of the work, to have appointments to important positions made by officials wholly ignorant of the work and its requirements, and to make such officials the arbiters as to whether inefficient assistants should be discharged. It is true that the regulations are evaded by allowing work under the charge of inefficient men to be discontinued, but this is no credit to the system, for if the rules are not such as can be squarely lived up to without detriment to the service they should be either modified or eliminated at once.

The navy department has recently established hydrographic offices at a number of our lake cities, and its officers are engaged in making surveys and in publishing and issuing charts without regard to the duplication of similar work being done under the direction of the engineer corps. A system of national public works which admits of unseemly quarrels between departments as to which shall have charge of different works; which allows the discrediting of the work of one department by another and the duplication of work and consequent waste of public funds; which promulgates such rules and regulations for its guidance that the cost of doing work and of disbursing the funds appropriated for its use is largely in excess of what it should be; whose members are liable to be court-martialed and to have their reputations and fortunes wrecked for not complying with regulations which it is probable that every officer in the corps is compelled to violate in order not to subject important works under their charge to serious delays and loss; which admits of petty jealousies relative to any river or harbor work designed or executed by civil engineers, and which it has been the policy of the organization to wreck financially if possible, would seem to embody all of the conditions summarized in the distinguished senator's statement that we have the worst system of national public works on the face of the earth. A military education is by no means an essential qualification for a successful river and harbor engineer; neither is it just that the graduates of our colleges and universities should be restricted in the practice of their profession by the government assigning all national improvements to a body of men educated at public expense. It is true that civil engineers are now occasionally appointed on engineer boards and commissions, yet assistant engineers in the United States service, although often the best qualified for such positions, are seldom so promoted, and as the experience of most engineers, outside of those who have been in the government service, has not been such as to qualify them for the duties to be performed on river and harbor work the army officers on such mixed commissions are in a position to control to a great extent the tenor of reports submitted.

If an attempt should again be made to reorganize the methods of conducting national public works no system should be considered which does not fully recognize the ability and attainments of the members of the present corps, among whom are many engineers, who is not hampered by the cumbersome system under which they serve would no doubt achieve national reputations.

During 1898 the number of officers of the engineer corps was increased 15 per cent. by act of congress, presumably for the reason that additional military engineers were needed in carrying on the war with Spain; but that reason now no longer exists, and if our standing army is to be largely increased, why should not the graduates of West Point attend to the fortification work, for which they were educated, and not be given a monopoly of the engineering on public improvements when the experience and education of the civil engineers and the business methods of civil life are far better adapted for securing economy and success? If the military duties of the corps have become such that it is necessary to largely increase the number of officers of that organization, it would seem proper that at the same time the rights of the civil engineer should be recognized, and that congress should also reorganize the system of conducting national public works so that the best practical results may be obtained at minimum expense and the ablest engineers of the country, whether military or civil, secured for the government service.

NEW TRANSATLANTIC LINERS.

The keel of the first of the new steamers to be built on the Clyde for the International Navigation Co. for service in the Red Star line has just been put down at the yard of the Clydebank Ship Building Co. President Clement A. Griscom informs the Review that the new steamers for the Red Star line service between New York and Antwerp—they are each 12,000-ton vessels—will be christened *Vaderland* and *Zeeland*. These steamers are of a type known as the "intermediate" type, possessing large cargo capacity, good accommodation for a medium number of passengers and fair average speed. President Griscom further states that the names *Haverford* and *Merion* have been selected for the 10,000-ton steamers building for the Philadelphia-Queenstown-Liverpool service of the International company. When contracts were let for the two Red Star liners it was announced that the other vessels would be built in the United States, but the company was unable to find a single ship yard in America that could guarantee delivery in anything like the time required, and so has been under the necessity of placing the contract for all four vessels with the firm on the Clyde. A large proportion of the material to be used in the construction of the four vessels will, however, be sent from America, and indeed the rudders and stern posts for the first two vessels are now under way at the works of the Chester Steel Casting Co. at Chester, Pa.

OPENING OF CHICAGO DRAINAGE CANAL.

Secretary of War Alger has given formal permission for the opening of the Chicago drainage canal, subject to conditions as follows: First, leaving it distinctly understood that the secretary of war will submit certain questions that have been raised to congress, and that the permit is subject to such action as may be taken by congress. Second, that if at any time it appears that the current created by such drainage work in the south and main branches of the Chicago river are unreasonably obstructive to navigation or injurious to property, the secretary of war reserves the right to close or modify the discharge through the channel. Third, that the sanitary district of Chicago must assume all responsibility for damages to property and navigation interests by reason of the introduction of a current in the Chicago river.

The canal was begun Sept. 3, 1892, and it had been expected to formally open it on Chicago day, Oct. 9 next, but it is hinted that the completion of the work by that time is an utter improbability and that the opening will have to be delayed until some time in 1900. Considerable sentiment against the canal has been worked up at St. Louis, and it is probable that this will be made manifest in various ways at the next session of congress.

MARINE REVIEW

Devoted to the Merchant Marine, the Navy, Ship Building, and Kindred Interests.

Published every Thursday at No. 418-19 Perry-Payne building, Cleveland, Ohio, by THE MARINE REVIEW PUBLISHING CO.

SUBSCRIPTION—\$2.00 per year in advance. Single copies 10 cents each. Convenient binders sent, post paid, \$1.00. Advertising rates on application.

Entered at Cleveland Post Office as Second-class Mail Matter.

The Canadian Manufacturer, one of the trade publications of the Dominion, is again disturbed on account of the suggestion that some arrangement be made with Great Britain and Canada for the use of the St. Lawrence canals in transferring vessels of war to the Atlantic coast, so that the United States government may take advantage of exceptional facilities for building the smaller kinds of war vessels on the great lakes. The Manufacturer says: "Questions that present themselves to the mind of the average reader are: Why does the United States government desire to have warships on the great lakes? Why does that government desire to amend or annul the Rush-Bagot convention in such a way as to permit the building of armed ships of modern types on the great lakes? Why is it considered that 'the old steamer Michigan' now only 'nominally' guards American interests on the great lakes? In what consists such 'guarding?' In endeavoring to suppress the desultory smuggling that may be carried on from Canada in small skiffs and row boats, would not rapid steam launches be more effective than any war ships that could be built? Or is it because the water is there to float them, and the ship builders are there who would be pleased to construct them that our neighbors are so frantically anxious to have war ships on the great lakes? Although 'the old steamer Michigan' may be the only war ship our neighbors maintain on the upper lakes, it is one more than what Canada has; and it is not true that Canada has violated the agreement by maintaining any war vessels whatever on any of the lakes. If the United States really desire to have war vessels on the lakes, seeing that the war vessels of no other power are there to confront them, or to be a menace to the peace of that country, it could be for no other purpose than a menace to Canada. Canada does not desire to maintain war vessels on the lakes, and until she does there can be no necessity for the United States to do so. It would not be wise to disturb the terms of the Rush-Bagot convention. The United States cannot build armed ships of modern types or of any other type on the great lakes for service in any other waters, and get them away from the ship yard in which they were constructed, except by the grace and permission of Canada, and Canada will never grant that permission."

It would seem from the editorial opinions of New York newspapers that the latest commission to take up the canal question in New York State will favor radical measures. One of the leading commercial journals of New York City says: "It is inferred by many of those who are familiar with canal problems, and who have been following very closely the work of the commission appointed by Governor Roosevelt, that the commission, in its preliminary report, favors the adoption of a plan by which either the Erie or the Oswego or the Champlain canal may be so enlarged that it will be possible to permit ocean-going vessels to pass to and from the great lakes and tidewater, or even to make the canal and lake passage only the beginning or continuation of an ocean trip. That is inferred because this plan is reserved for the last of the suggestions made by the commission in its preliminary report. It is also inferred that the commission is now decidedly in favor of co-operation between the state of New York and the federal government, whose surveyors are busy to-day looking for a feasible route for a national ship-canal connecting the lakes with the ocean. Such a canal would cost not less than \$200,000,000, but it is known that some of the members of the commission feel that there would be greater economy in spending \$200,000,000 if thereby a true ship-canal could be built than in spending \$25,000,000 for merely a barge canal. The commission seems to be clearly of the opinion that the canal problem can only be wisely solved by building a ship-canal, and that the other alternative is the abandonment of our canal system, although it would require a constitutional amendment to do that."

Government inspectors stationed at the works of the Wm. R. Trigg Co., Richmond, Va., report that they are entirely satisfied with the progress made and the methods used in the construction of the torpedo boats and destroyers for which the Trigg company has the contract. Especially are the pipes, bearings and all sorts of metal castings being turned out in a manner that has elicited the admiration of the government officials stationed at Richmond.

It appeared for a time as if the people of the state of Kentucky would be obliged to give up the project to present a silver service to the battleship Kentucky, now building at Newport News, Va., because of a lack of funds, but the matter has now assumed a brighter aspect. It is stated that the \$6,000 necessary has been subscribed, and that the committee on the selection of a design will report in the near future.

Ship building on the Delaware river has never been in more prosperous condition than at present. There are now building a total of fifty-four vessels including three battleships, one cruiser, fourteen steamers, two steamboats, seven yachts, six torpedo boats, eight towboats, one barge, one ferryboat, a fumigating barge, dredging barge, a floating elevator, three scows and five derrick barges.

On a recent transatlantic voyage the North German Lloyd twin-screw steamer Kaiser Friedrich lost two blades of her port propeller. The accident is said to have been due to a defect in the metal.

WAR SERVICE OF AUXILIARY VESSELS.

The experience of the United States during the Spanish-American war and the excellence of the service rendered by our efficient, if hastily assembled fleet of auxiliary vessels has served as probably nothing else could have done, to direct the attention of naval students of all nations to this class of craft. In commenting on the showing made by the American vessels and the lessons to be deduced therefrom the Admiralty and Horse Guards Gazette of Great Britain says:

"The old question whether merchant steamers and yachts can be utilized for warlike purposes, and, if so, to what extent, derives increased importance from the occurrences of the recently terminated Spanish-American war. Some of the vessels employed in the service of the United States did render really considerable assistance as transports and supply ships, and in the case of two yachts, the Gloucester and Vixen, took a considerable and, under the circumstances, remarkable part in the blockade of Cuba and the actual fighting at Santiago. Although it cannot be denied that the measure of success which attended the employment of these auxiliary vessels was due rather to the enemy's apathy and weakness than to any intrinsic fitness of their own for special services they performed, they undoubtedly did much valuable work in relieving ships of the regular navy of a number of duties which would otherwise have withdrawn the latter from more purely military functions. The beginning of the war found the navies of both Spain and the United States deficient in the vessels necessary for the performance of a variety of accessory services. The United States, however, thanks to their financial situation, the industrial resources of which they disposed, and above all owing to the energy and readiness which are so characteristic of the people, were able to rapidly transform, arm, and utilize a large number of the vessels hastily acquired at or just before the beginning of the war, whilst such vessels as the crippled finances and limited resources of Spain enabled her to procure turned out to be rather an encumbrance than a help.

"The success of the American auxiliary vessels, therefore, should not blind us to the danger of placing undue reliance on the employment of merchant steamers or yachts as auxiliaries in time of war, they being, as a rule, of too weak structure to carry artillery, and often of limited coal capacity and having their engines and boilers above the water line, and therefore unprotected against attack. Nor is it always, or even usually feasible to remedy these defects without structural changes, which are costly, involve considerable delay, and can frequently only be effected to the serious detriment of sea-going qualities. But even when necessary modifications can be accomplished in a satisfactory manner, the question of speed would still remain to be considered, only a very limited number of vessels of the class we are considering being capable of attaining such a speed as would offer a reasonable chance of escaping the pursuit of hostile cruisers. That the American auxiliary vessels were able to render the services they did in the face of these disadvantages can only be ascribed to the fact that the command of the sea was held throughout the war, from start to finish, by the United States, and that this is so is clearly recognized by the Americans themselves, who wisely resolving never to again be forced to rely on the services of hastily purchased vessels, are providing for the construction of an auxiliary fleet specially designed for the performance of those accessory services which experience has shown to be requisite to maintain the fighting squadrons of a fleet in full efficiency. Store ships, hospital ships, repairing ships, despatch vessels, etc., relieve the regular cruisers and smaller fighting vessels of much work which would otherwise devolve upon the latter, and some auxiliary vessels may even, as did the Gloucester and the Vixen at Santiago, play a useful and opportune, if subordinate, part in actual fighting, where such vessels as torpedo boats and scouting vessels are concerned. Great ocean liners such as the Lucania, Etruria, St. Louis, and others, will in all probability be called upon to render valuable service in future naval war, especially as colliers, their great speed affording security against capture by an enemy's cruisers, whilst the coal capacity of a 10,000-ton ocean liner would enable her to fill the bunkers of three or four of the largest fighting vessels, in which latter the demands made by the necessity of carrying heavy guns and adequate armor protection must always limit fuel capacity—a tendency which, with the growing power of artillery, and consequent need of increased defensive armament, we may expect in future even more marked than it is at the present time."

J. W. Westcott of Detroit announces that in accordance with arrangements made by the Lake Carriers' Association with Duff & Gatfield of Amherstburg, changes in draught of water in the vicinity of the Lime-Kilns crossing, Detroit river, will be shown from the coal docks of Stanley B. Smith & Co. and the Cuddy-Mullen Coal Co. The figures on coal docks showing the stage of water will be illuminated by night. The same information may be obtained at the office of J. W. Westcott, foot of Woodward avenue, Detroit. No charge will be made for this service, but captains calling Duff & Gatfield by telephone will do so at their own expense.

Col. Jared A. Smith, United States engineer at Cleveland, is to re-advertise for proposals for dredging Cleveland harbor. June 9 is the date fixed for the second opening of the bids. Col. Smith intimates that for some time past the dredging bids seem to have been so arranged on the lakes that the contracts have been divided by districts. He says that the government will undertake the work if satisfactory figures can not be secured from the contractors.

Niclausse boilers now building by the Stirling Co. of Chicago for the Russian cruiser and battleship and the United States battleship Maine, under construction at the works of Cramp & Sons, Philadelphia, will aggregate 58,000 horse power.

The Merritt-Chapman Wrecking Co.'s new tug Rescue will tow the recovered cruiser Reina Mercedes from Santiago harbor to her destination in the United States.

JAMES HOWDEN ON DESTROYERS.

A paper on "Torpedo Boat Destroyers for Sea Service," read before the recent meeting of the Institute of Naval Architects in London by Mr. James Howden of Glasgow, possesses a considerable degree of interest for American readers for the reason that the author is well-known here as the inventor of the Howden system of hot draft and also on account of the comment which he made on plans of a torpedo boat destroyer submitted by Superintendent Dickie of the Union Iron Works, San Francisco, at the last meeting of the Society of Naval Architects and Marine Engineers in New York. Mr. Howden in his paper held that the minimizing of all weights in torpedo boat destroyers in order to secure high speed on a short trial under the most favorable conditions incapacitated the boats from fulfilling their principal service, that of protecting a fleet of warships at sea, or, when blockading, from the attack of torpedo boats. The vessels were too light to withstand the force of sea waves at a low speed, and much less, therefore, at a high speed, so that they could never be relied upon in a sea. Their lifetime would be short, and the watertube boiler was not fitted for continuous working at sea. It would, therefore, be preferable, in his view, to increase the size of the ship, so that she could take cylindrical boilers to make such continuous steaming possible at a maximum speed surpassing the highest speed of any warship or cruiser afloat. This speed, he thought, should be $23\frac{1}{2}$ knots, not on a short trial, but on a run of several consecutive days. This view was the same as that strongly expressed by Mr. George W. Dickie, of the Union Iron Works, San Francisco, and Mr. Howden proceeded to show Mr. Dickie's conception of the requirements, and then evolved a design largely on the same lines for a vessel of 240 feet in length, 26 feet breadth, with 15 feet moulded depth, and of 640 tons displacement at 8 feet draught, with 60 tons of coal in the bunkers, but with capacity for 160 tons more at 9 feet 7 inches draught. But instead of having four Thornycroft boilers, as Mr. Dickie's design, Mr. Howden adopted two double-ended cylindrical boilers, with his own system of forced draught, the space occupied being 14 feet less in the length of the ship. Mr. Howden also reduced the speed from 25 knots to $23\frac{1}{2}$ knots, which he thought ample, and the power from 7,000 to 4,600 indicated horse power. His boilers were designed to give the same results as were being obtained in many merchant steamers—continuous working under ordinary conditions, so that they could be relied upon. The weight with water to steaming level and all fittings was 162 tons for 4,600 indicated horse power, and for the water tube boilers in Mr. Dickie's design, 133 tons for 7,000 indicated horse power. The weight of machinery was based on Mr. Dickie's design, which, again, was more liberal than in any destroyer. For 7,000 indicated horse power it was 97 tons, for 4,600 indicated horse power 68 tons, without evaporating plant, etc., only necessary with water tube boilers which could not use salt water. Mr. Howden thought such a ship of $23\frac{1}{2}$ knots continuous sea speed, with 1 inch nickel steel protection, was greatly to be preferred to the light destroyers now being built.

CONTEMPLATED HARBOR IMPROVEMENTS IN CANADA.

Both governmental and private enterprise in Canada seems to be active in the highest degree in planning for improvements that are intended to secure to shipping interests of the dominion a considerable share of the grain trade and other traffic between the great lakes and the Atlantic seaboard. Applications are being filed at Ottawa almost daily for grants and subsidies for works of national development. The most extensive improvements are contemplated for Montreal, where it is estimated that \$2,000,000 can be expended advantageously in new harbor works and terminal facilities, without allowance for a dry dock which, if constructed, will cost \$1,000,000 additional. At Quebec railway, bridge and harbor improvements to cost \$4,000,000 have been projected and the government has been asked for an appropriation of \$1,000,000. The Port Colborne and Port Dalhousie grant of \$500,000 will probably be found insufficient to deepen and improve harbors to the extent desired. For a short-cut railroad as a connecting line between Collingwood and Toronto for lake traffic developing at both of these points the estimate is \$1,000,000. Toronto harbor improvements are figured at \$1,000,000, while Hamilton harbor ask for \$500,000 and Collingwood harbor \$250,000. For improvements of the channel of the St. Lawrence below Montreal estimates are before the government to the extent of \$500,000, and this does not include light-houses, fog signals, etc. Moreover there are other projects booked for early attention, and from all of which it will be seen that the Canadian authorities are likely to have their hands full for some time to come in trying to satisfy different sections of the country. Their determination to do as much as possible seems to have been strengthened by the action of the last United States congress in appropriating or authorizing the expenditure of \$4,195,500 on Lake Erie harbor improvements alone.

Shipments of the Lidgerwood Manufacturing Co. of New York during the month of April included ten hoisting engines forwarded to South African ports and six to Australia. Orders for these machines were received through an English house, and were valued at \$15,000. A large double drummed hoister is now being constructed to the order of a Newfoundland concern.

It is rumored that the Armstrong Co. on the Tyne, England, has just disposed of two high-speed cruisers, built for "stock" to the Chinese government. Two cruisers very similar in type were recently launched for the same power.

Ten days stop-over at Washington—Tickets to Philadelphia and New York over Pennsylvania short lines may be obtained via Washington, and good for a ten days' visit at the national capital, at the same fare as apply to Philadelphia and New York over direct lines of Pennsylvania system. For further particulars apply to Pennsylvania lines ticket agents or address C. L. Kimball, passenger agent, Cleveland, O.

SPEED TRIALS OF BIG SHIPS.

During the recent cruise of Admiral Sampson's squadron, all the vessels participated in a speed trial at which some rather remarkable showings were made. The New York made the best speed, 19.2 knots on an average, the Brooklyn making less than 17. The Massachusetts made 14.82 knots on an average and the Indiana considerably less, having been able to use forced draft on only one boiler. The Texas made 12.2 knots. The showing of the Massachusetts was remarkable, even considering her favorable condition. Her revolutions under natural and forced drafts numbered 110.15 and 119.08 to the minute, and her speed was 14.1 and 15.2 knots an hour. She developed 10,891 and 14,713 horse power. The trial compares very favorably with her builders' trial, during which her displacement was nearly 1,000 tons less and her speed only 1.42 knots greater. Economy of the coal consumption was a most important feature in her speed trial and was apparent throughout her cruise. She left New York April 20, steamed between 3,700 and 3,800 miles, including the speed trial, in which 66,000 pounds of coal was used, and reached New York again May 2 with 230 tons remaining in her bunkers, which proves that the ship has a 4,000 mile radius of action.

The showing of the New York was also excellent. Her revolutions numbered 118 on an average under natural draft, and reached a maximum of 134 under forced draft, which is the same figure reached on her builders' trial. About 15,000 horse power was developed, with a consumption of 2.3 and 2.5 pounds of coal to a horse power. The New York had a greater displacement by 1,800 tons than on her builders' trial. The Brooklyn consumed more coal than either the New York or the Massachusetts. Her showing was inferior to that of the New York in several ways, which verifies a statement ascribed to Mr. Cramp that he never built a better boat than the New York.

VALUE OF NEW NAVAL VESSELS.

The United States navy department has compiled a statement showing the value of the vessels building for the department in the various ship yards of the United States. The State of Virginia stands first with 37 per cent. of the total work in her yards; California second with 23 per cent., and Pennsylvania third with 20 per cent. The statement in detail is as follows:

Newport News Ship Building & Dry Dock Co., Newport News, Va.	\$10,840,000
Union Iron Works, San Francisco, Cal.	7,303,950
William Cramp & Sons, Philadelphia, Pa.	5,535,000
Bath Iron Works, Bath, Me.	1,845,000
Lewis Nixon, Elizabethport, N. J.	1,155,000
William R. Trigg Co., Richmond, Va.	909,250
Neafie & Levy, Philadelphia, Pa.	849,000
Maryland Steel Co., Sparrow's Point, Md.	858,000
Harlan & Hollingsworth Co., Wilmington, Del.	818,000
Fore River Engine Co., Weymouth, Mass.	562,000
Gas Engine and Power Co., Morris Heights, N. Y.	492,000
Lawley & Sons, South Boston, Mass.	318,800
Columbian Iron Works, Baltimore, Md.	318,000
Wolff & Zwicker Iron Works, Portland, Ore.	214,000
Total	\$32,018,000

SIGNALS ON SMITH'S COAL DOCK.

A note from Stanley B. Smith & Co. of Detroit regarding the display of signals on their coal dock in the Detroit river showing depth of water at the Lime-Kilns crossing, as reported by Duff & Gatfield, says:

"The changes during low water will be shown by day by white figures upon black background, and at night by illuminated figures. When the water is over 18 feet deep no figures will be shown. These signals are placed just over the office at the upper end of the pockets, and can be read, without glasses, one mile away. The service will be in force from May 10 until the close of navigation."

The vessel interests certainly have reason to feel thankful to Stanley B. Smith & Co. in this matter, as the signals are to be maintained by the dock management without expense of any kind to the Lake Carriers' Association, either for illumination or other service. The new arrangement will undoubtedly be of great benefit to vessel masters who have heretofore been compelled to sacrifice time in rounding to and telephoning to Amherstburg.

STOPPAGE OF STEAMERS GOING AT FULL SPEED.

Discussion regarding the invention of several new types of marine brakes has caused some controversy as to the time and elapsed distance required to stop modern ocean-going steamboats with present appliances. The following calculations as to the length of time and distance required to stop a steam vessel going full speed ahead when the propelling machinery is reversed were made by W. D. Weaver, late assistant engineer of the United States navy, for the Engineer of London:

	Displacement	Horse Power.	Speed.	Distance.	Time.
				Feet.	Seconds.
Etruria (Cunard).....	9,680	14,321	20.18	2,464	167
Lepanto (Italian).....	4,680	15,040	18	2,522	192
Columbia (U. S.).....	7,350	17,001	22.8	2,147	135
Yorktown (U. S.).....	1,700	3,205	16.14	989	83.9
Bancroft (U. S.).....	832	1,170	14.52	965	91
Cushing (U. S.).....	105	1,754	22.48	301	18.4
Wiborg (Russian).....	138	1,303	19.96	373	25.6

The Spanish-American war was even more detrimental to Spanish commercial and shipping interests than at first supposed. Reports just compiled for the port of Corunna, one of the principal harbors in the kingdom, show that during the year 1,158 steam and sail vessels entered and cleared. This is only a slight decrease over the former year, but the aggregate tonnage, 983,121 tons, shows a falling off of 75,051 tons.

WORK OF THE CABLE SHIP.

The Review herewith presents a sectional view of the United States cable ship Hooker, just fitted for the service in the Philippines and which was fully described in these columns last week. The Hooker, which was formerly the Panama—one of the prizes of the Spanish-American war—is 325 feet in length by 33 feet beam and of 2,000 tons burden. She is fitted with a 1,600 horse power engine, which is expected to drive her at a speed of 12 knots. In appearance she now approximates closely the standard type of cable-laying or cable-repair ship. She has been practically reconstructed by the Morse Iron Works of South Brooklyn, and fitted with three large cable tanks, built specially for their duty. The largest of these is placed amidships and holds 130 miles of cable. The forward tank holds 35 miles of deep sea cable, and the aft tank holds a few miles of the heavily armored shore end. The midships tank is 24 by 13 feet, the forward tank 13 by 8, and the aft tank 26 by 6, the total capacity being 700 tons of cable. The equipment of the vessel includes picking-up and paying-out gear, bow sheaves, etc., built by the Lidgerwood Manufacturing Co. An electric light plant aboard the vessel is of the direct-coupled type, the engines being furnished by the Buffalo Forge Co.

MORE CONTRACTS FOR HARLAN & HOLLINGSWORTH.

The Harlan & Hollingsworth Co., Wilmington, Del., has just contracted with the New York & Baltimore Transportation line for two freight steamers of the following dimensions: 219 feet over all; 205 feet between perpendiculars; 32 feet beam, moulded; depth to upper deck, 23 feet 6 inches; to carry 900 tons on 13 feet 6 inches draught. Other particulars of the vessels are: Four water tight bulkheads; three side ports on each side; steel deck house and two wooden masts; electric lighting plant of 100 16-candle-power lights; one tank of 500 and one of 1,000 gallons capacity; triple expansion engine with cylinder of 18, 28 and 45 inches diameter by 30 inches stroke; two Scotch boilers 11 feet diameter by 10 feet 6 inches long; speed of 12 knots loaded.

Work at the Wilmington yard is progressing rapidly, and it is expected that the torpedo boat destroyer Stringham will be launched the

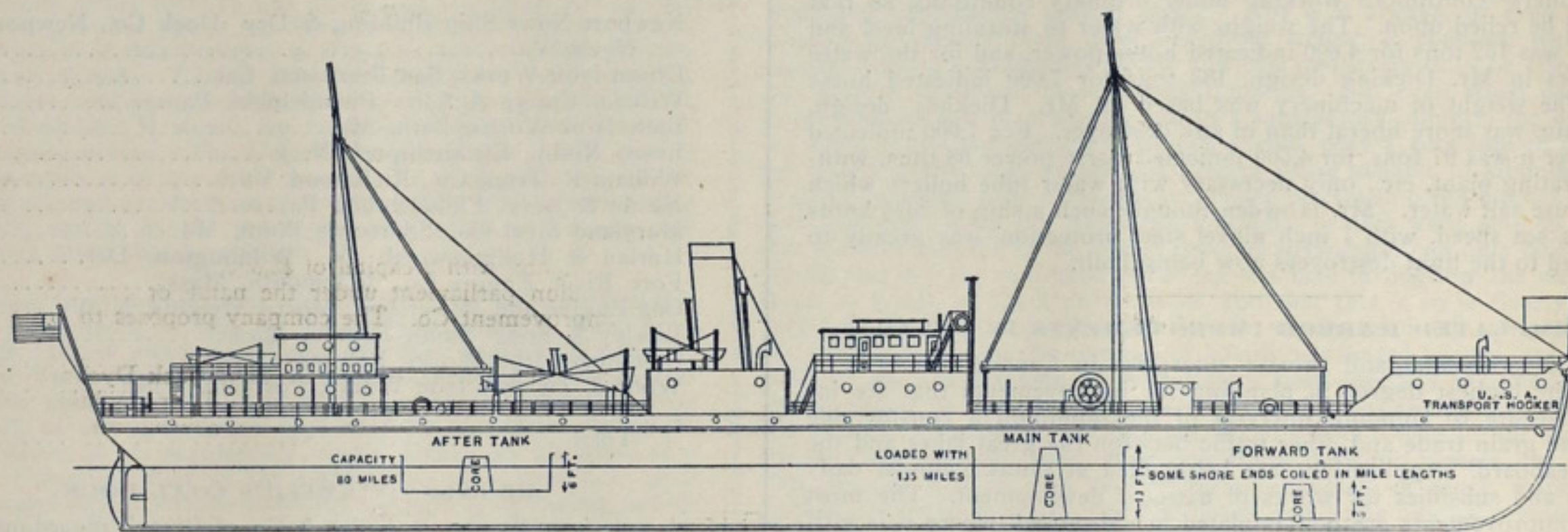
PROGRESS ON THE ST. LAWRENCE CANALS.

In speaking of the progress made in the enlargement of one section of the St. Lawrence canals, upon which work has been in progress for some time, a correspondent of the Engineering News says:

"The enlargement of the Iroquois section of the Galops canal is practically completed, and the canal will be opened in a few days. This section extends from Iroquois, on the St. Lawrence river, to a point three miles west, where it connects with the Cardinal Section. The work included $2\frac{3}{4}$ miles of excavation and embankment, about one mile of this being through the St. Lawrence river. The lock is 800 feet long, subdivided into two chambers of 530 and 270 feet, 50 feet wide and 14 feet deep on sill at low water; it has a lift of 12 feet at normal river. The masonry walls are extended on both ends about 250 feet, making a total length of wall about one-quarter mile long and averaging about 33 feet high. The contract was let to Larkin & Sangster early in 1897. In the balance of that year considerable excavation and embankment was executed and a crib dam with a puddle core was constructed around two sides of the lock pit, enclosing a part of the river. The greatest depth of water was 18 feet. By March 30, 1898, the earth was excavated from the pit and the rock work was commenced, and by July 30, 40,000 cubic yards of rock were removed. The masonry was commenced about July 1 and by the end of 1898 42,000 cubic yards had been built, with all the masonry above water level. In the month of September 12,500 cubic yards of masonry were laid. All work is now done excepting the placing of the gates. This work was designed and carried out under the direction of Mr. T. S. Rutledge, with Mr. G. C. Carmen as resident engineer and Mr. R. A. Davy, engineer in charge of lock work."

YACHTING ON THE GREAT LAKES.

The international yacht race to be sailed this summer on the great lakes has served to arouse a greater degree of interest in the sport than has been manifest in some time. The Lake Michigan yachts will have a cruising race at Mackinaw island the latter part of July. The fleet, which will of course include both sail and power boats, will then proceed to Put-in-Bay, Lake Erie, for the annual meet of the Inter-Lake Yachting



UNITED STATES CABLE SHIP HOOKER.

latter part of this month. The Maracaibo for the Red D line will be launched in June and followed by the Ponce for the New York and Porto Rico Steamship Co. in July. Work on the Ponce's sister-ship, the San Juan, is being pushed rapidly and she will probably shortly follow. All three of these ships are being built under the supervision of Mr. John Haug. Work on Windsor ship No. 4, is also progressing and the torpedo boat destroyers Nos. 6 and 7, Hopkins and Hull, are well in frame. The steamship Nantucket of the Merchants & Miners' Transportation Co., is nearing completion and will have her trial trip this month.

Owing to a liberal appropriation from the last congress, the Christiana river will be greatly widened and deepened; in fact, it will have a uniform depth of 24 feet at mean low water. This will permit ships of any size being built on its banks. The Harlan & Hollingsworth Co. contemplates building 600-foot ways to accommodate the building of the largest steamers. During the past year they have made a number of improvements in their plant. Many new tools have been added, and the claim is made that this company is now probably better equipped for quick work than any ship yard in the country.

The Fleming line of steamers, formed to take the place of the Parks Foster and Iron Owen in service this season between Chicago and Fairport, in connection with the Baltimore & Ohio railroad, will include the Escanaba, B. W. Blanchard and Mary H. Boyce. P. H. Fleming is general manager and O. G. Orr assistant general manager of the line. The name of the Escanaba will be changed to Baltimore.

C. F. Bielman of Detroit has finally secured from the postoffice department a four-year contract for the services of his little steamer Florence B in the delivery of mail on the Detroit river. The compensation is to be \$18 a day for time when the boat is actually employed. The Florence B was recently fitted up so that she is especially suited to the work.

The United States navy is now drawing almost its entire requirements in fuel from the Pocahontas interests represented by Castner & Curran of Philadelphia. Pocahontas coal is the standard coal of the navy and is probably the finest steamboat fuel of the world. It is used exclusively by the Cunard and White Star steamers.

Association, which will open July 31 and continue until Friday evening, August 4. It is certain that the fleet of power yachts and cruising launches in attendance at the Lake Erie meeting this year will be far in excess of the representation at any previous regatta. On Tuesday and Wednesday, August 8 and 9, a regatta will be held at Erie, Pa. It is expected that the fleet will reach Toronto August 14 or 15. Two new organizations, the Up River Yacht Club of Toledo and the Presque Isle Yacht Club of Erie, Pa., will be represented at these regattas.

"THE LITTLE RED BOOK."

By accident the above name was given to a vest-pocket directory of owners and officers of lake vessels. For several years past the Marine Review Publishing Co. has collected and arranged in handy form for reference the appointments of captains and engineers of lake vessels. No name was especially selected for the first issue of this list. It happened to be bound in a red cover. It became popular at the outset on account of its value to everybody having dealings with vessels or the owners of vessels on the great lakes. It was a little red book and everybody referred to it by that name. The name was adopted and placed on the cover of the book. Now there is inquiry each year for hundreds of copies of the "Little Red Book" long before the list is completed. The 1899 issue is just off the press. This list shows at a glance the name of owner, captain and engineer of any lake vessel. It is also a collection of ship owners with their post office address. It sells at \$1.

The spring announcement of Mr. W. F. Herman, general passenger agent of the Cleveland & Buffalo Transit Co., is as gay as the millinery of the season, and with striking appropriateness it is flowery in every sense of the word. The line's magnificent new steamer City of Erie is represented resting upon a bed of roses, while below is the welcome announcement that the C. & B. fleet "the flower of the lake marine" again blossoms forth with regular trips. For the time being sailings will be made from Cleveland at 8 o'clock and from Buffalo at 9 o'clock each evening, except Sunday, and after May 28 the service will be resumed every day in the week, permitting of the popular excursion trips to Cleveland and Niagara Falls.

AROUND THE GREAT LAKES.

The monster dredge Pan American, built by Hingston & Woods of Buffalo, has been given a trial and proved highly successful.

The steam yacht Rival, recently purchased by A. W. Goodrich of the Goodrich Transportation Co., Chicago, will be entirely refitted and is expected to make 16 miles an hour.

The Anderson ship yard at Marine City has launched a steam barge building for Belknap & Phillips of St. Clair. She is 92 feet keel, 103 feet over all, 33 feet beam and 8 feet depth.

On a recent trial trip to test the engines fitted in the Star line steamer Greyhound by S. F. Hodge & Co. of Detroit, the vessel developed a speed in excess of 20 miles an hour.

Darius N. Avery, vice president of the Detroit, Belle Isle & Windsor Ferry Co., died at Detroit last week, aged fifty-three years. He was at one time interested in the lumber business.

Bids have been invited for the purchase of the wrecked steamer Aurora, formerly of the Corrigan fleet, which was burned in Detroit river late last season and later towed to Detroit.

Major L. C. Overman, who was the predecessor of Col. J. A. Smith as government engineer at Cleveland, was killed at his cottage at Nantucket, Mass., a few days ago by a fall from a staging.

Messrs. William E. Stowe and Charles J. O'Connor have associated themselves for the special practice of admiralty law under the firm name of Stowe & O'Connor, with offices at 806 Marquette building, Chicago.

Capt. James Davidson of West Bay City, Mich., will rebuild the schooner T. S. Fassett, which was wrecked at Sand Beach last autumn. The steamer F. E. Spinner has also arrived at Davidson's yard to be transformed into a lumber barge.

Many lake navigators will regret to learn of the death of Capt. Wm. Egan, for many years chief mate of the Goodrich liner Virginia, which occurred some days ago at his home at Manitowoc. He was aged thirty-two years.

Considerable praise has been bestowed upon the management of the Singer tug line at Duluth for the service which the tugs Superior and Excelsior performed in rescuing the steamer Troy, which was caught in the ice off the port of Duluth.

Capt. M. C. Clark, Thomas Isabell and William Binks of Sturgeon Bay, Wis., have purchased for \$500 the burned and sunken steamer Otego now lying in the river at Green Bay. After the Otego has been pumped out she will be taken to Sturgeon Bay for repairs.

Extensive improvements have been made in the steamer Jesse H. Farwell, under charter to the American Steel & Wire Co. She has been fitted with two gangways on the port side, a new and complete rig for handling package freight, and new steering gear.

The burned hull of the steamer Joys at Sturgeon Bay, Wis., will not be rebuilt, the keelson, frames and planking having been burned so badly in places that a rebuild would not be warranted. The propeller wheel, shaft, rudder, and shoe have been removed from the vessel.

Work has been commenced on the removal of the wreck of the steamer City of Duluth in the harbor entrance at St. Joseph. Capt. Jex with the wrecking schooner Judd last week secured the engine and boiler. It is anticipated that the entire summer will be required for the removal of the wreck.

T. H. Wait, representing English underwriters, is again on the lakes, and is authorized to contract for the release of the steamer Harlem, which wintered ashore on Isle Royale, Lake Superior. A tug will make a trip from Duluth as soon as the condition of the ice will permit to ascertain the condition of the vessel. The job of releasing the Harlem will undoubtedly prove quite difficult.

Clearance was made a few days ago from South Lake Linden by the steamer Nicol with the first cargo of ingot copper shipped since the opening of navigation. It is stated that the supply of refined copper on the docks at the opening is the smallest in twenty years, owing to the fact that the urgent demand for the metal led to a continuance of all-rail shipments up to within three days of the opening of navigation.

Incorporation of the McReynolds Elevator Co. of Chicago, with a capital stock of \$300,000 is taken as a confirmation of the rumor that the recent purchase by McReynolds of the tract of land on the east side of the Calumet river at 106th street was with a project for the construction of an elevator in view. Additional color is perhaps given to the story by the fact that money has been appropriated to dredge the river beyond 106th street.

M. Payne, sub collector of customs at Port Stanley, Ont., furnishes the United States hydrographic office with the information that captains of vessels trading up and down the shore of Lake Erie report that the wreck of the schooner Groton is still visible for a few feet above the water off Talbot point, and that the wreck is very dangerous to navigation during the night or foggy season, owing to the fact that the masts cannot be seen until close aboard.

The sale of the steamer Sachem and the schooner City of Toledo by Ed. E. Ayer of Chicago to the Mitchell & Rowland Lumber Co. of Toledo, marks the retirement of Mr. Ayer from further active interest in the lumber carrying fleet. The consideration is understood to have been \$30,000 cash in the case of the steamer and \$3,000 in the case of the schooner. The Sachem was built ten years ago, and has a capacity of 725,000 feet of lumber.

Work will be resumed on the wreck of the steamer Pewabic in Thunder Bay, Lake Huron, about the middle of May, according to W. Milbrath of the American Wrecking & Salvage Co., Milwaukee. The steamer H. A. Root and the Smith diving bell, described in the Review last autumn, will be utilized. President Milbrath states that his company is also figuring with the underwriters on a proposition for the removal of the steel billets from the wreck of the E. B. Hale, lost in 1897.

IN SHIP YARDS WHERE BUSINESS IS BRISK.

Capt. E. J. Howard of Jeffersonville, Ind., has the frame completed for a new boat building for Capt. Cooley for service on the Ouachita river. Frames are also in position for the Red River steamer building for Carter Bros. Keels have been laid for two new steamers to be built for the Lee line and excellent progress has been made on the large towboat building for W. R. King, and on the three steel vessels under construction for the United States government.

The Gas Engine & Power Co. and Seabury & Co., Consolidated, of Morris Heights, New York, have secured the contract for the construction of a twin-screw steam yacht for W. H. Ames of Boston. She will be 114 feet over all, 93 feet water line, 14½ feet beam, 8½ feet depth and 5 feet draught. The yacht, which is to be completed by August 1, will be schooner rigged and a speed of 15 miles per hour is guaranteed.

The ship yard of the Hillman Ship & Engine Building Co. at Philadelphia will continue in operation despite the receivership proceedings some time ago. The three lake steamers purchased by the Manhattan Steamship Co. are now refitting there. It is rumored that the Hillman yard may be disposed of to an outside syndicate.

Contracts have been let by the Pennsylvania Railroad Co. for the construction of fourteen wooden freight barges of 100 feet length. The New Jersey Dry Dock Co. of Elizabeth, N. J., will build seven of these, the Jackson & Sharp Co. of Wilmington, Del., will build four, and Morris & Mathias of Wilmington, three.

The Elizabeth River & Hampton Roads Ferry Co. has been incorporated at Norfolk, Va., and will maintain a ferry service between points on the Elizabeth and James rivers and Hampton Roads. G. M. Serpell is president and J. A. C. Groner, secretary and treasurer.

Application has been made to the legislature of New Brunswick for the incorporation of the Imperial Dry Dock Co. with authorized capital of \$1,000,000. The prime mover in the enterprise is George Robertson of St. John.

A sister vessel to the steamer Swift, in service on the Ottawa-Kingston route, via the Rideau, is being built by the Davis Dry Dock Co. of Kingston, Ont. The Swift is being enlarged and a daily service between Ottawa and Kingston will be instituted.

G. H. Bertram of the Bertram Engine Works, Toronto, and other prominent Canadian capitalists, are among the incorporators of the Rainy River Navigation Co.; capital is \$99,000, with general offices at Ray Portage, Ont.

The construction of another vessel will be ordered immediately to replace the ferry boat Chamberlain which was in service between Chamberlain and Oacoma, South Dakota, until wrecked by an explosion some weeks ago.

A company with a capital of \$2,500,000 is seeking incorporation from the dominion parliament under the name of the Yukon River & Atlin Lake Improvement Co. The company proposes to build wharves, locks, boats, etc.

It has been decided to give the name Jack Dyckman to the tug which John H. Dialogue & Son of Camden, N. J., are building for W. S. Limond. She will be 5 feet longer than the Dorothy Annan, built for Mr. Limond some time ago.

A slight blaze threatened the destruction of the ship yard of John H. Dialogue & Son at Camden, N. J., some days ago, but fortunately the fire was extinguished with a loss of only \$3,000, fully covered by insurance.

Two 814-yard dump scows will be built by the Petersburg Iron Works Co. of Petersburg, Va., for the Virginia Dredging Co. The scows will be considerably larger than those heretofore built for the same firm.

A stern-wheel steamer 80 feet in length, 20 feet beam and 8 inches extreme draught, for service on the Upper Willamette river, will be constructed at the yard of Joseph Supple, Portland, Ore.

Lewis Nixon's Crescent Ship Yard at Elizabethport, N. J., is running night and day and it is stated that there is work on hand to keep the plant in operation to its fullest capacity for two years.

Manager Fenton of the Manchester, Mass., ship yard has secured two new contracts, one for a yacht from designs by Gardner & Cox, naval architects of 1 Broadway, New York.

Calvin Adams of Calais, Me., has contracted to build for the Continental Packing Co. a small steamer 45 feet long by 10 feet beam with a 6 by 6-inch high pressure single engine.

The Lake Geneva Steamboat Co. has launched at Harvard, Ill., the steamer Moravia, which will be by far the finest craft in service on Lake Geneva.

The New England Ship Building Co. of Bath, Me., has just closed a contract for the immediate construction of five more coal barges.

William W. Finch of Wilkesbarre, Pa., will launch a handsome 30-foot gasoline launch at Harvey's lake, near the above city.

There are now employed regularly at the ship yard of the Wm. Cramp & Sons Co., Philadelphia, a total of 7,892 men.

Percy & Small of Bath, Me., will this month launch a five-masted schooner to be named the Myron D. Cressey.

The board of county commissioners at Seattle, Wash., has called for plans for a ferry to ply on Lake Washington.

The Lake Labelle Navigation Co. of Labelle, Quebec, Can., has been incorporated with a capital of \$10,000.

The Henry G. Morse ship building project has been incorporated as the New York Ship Building Co.

Inquire of agents of the Nickel Plate road about dates of sale, time of trains, connections and routes to San Francisco, Cal., for the National Baptist Anniversaries, May 26 to 30. One fare for the round trip.

23, May 11.

WATER TUBE BOILER TESTS.

EXHAUSTIVE REPORTS OF TRIALS OF THE BABCOCK & WILCOX TYPE OF STEAM GENERATOR ON THE BRITISH TORPEDO GUNBOAT SHELDRAKE.

In view of the large number of merchant steamers in this country fitted with water tube boilers of the Babcock & Wilcox type, and as these boilers are now in use in vessels of the Russian, Norwegian and United States navies, the following particulars of trials of the British torpedo gunboat Sheldrake will prove interesting:

The Sheldrake has twin-screw triple-expansion engines of 3,500 collective horse power. Each engine has cylinders 22, 33 and 49 inches diameter, with a stroke of 21 inches. There are two boiler compartments—divided by a watertight bulkhead—two boilers in the forward compartment, and two in the after compartment. Each pair of boilers are placed back to back; each boiler having its own stokehold. The boilers are fired fore and aft. The total heating surface in each boiler is 2,356 square feet, and the grate surface 63 square feet. The boilers are worked at 200 pounds pressure per square inch, reduced by means of reducing valves to 150 pounds per square inch at the engines; and the steam on its way to the engines passes through separators. The boilers are composed of nineteen sections of tubes, including side sections. The tubes throughout are of solid drawn steel, galvanized on the outside by the electro-deposition process in accordance with the usual Admiralty requirements. The tubes connecting the headers and cross-boxes together are 1 13-16 inches diameter—those between the headers are 7 feet 6 inches long, and those in the crossboxes 7 feet 4 3/4 inches. The uptake headers are connected to the steam and water drum by 4-inch tubes; 4-inch down-comer tubes are taken from each end of the steam and water drum, and connected to a mud-box, this box being provided with blow-off and drain valves. The level of the water in the drum is regulated by means of Thornycroft's feed-water regulators. The stokeholds are arranged so that the air supply

Trial No. 1 was an official full power trial. The steam jet referred to was used in the funnel, and the results actually obtained show that with only 1/4 inch pressure in the ashpit, instead of 3 inches, and during three hours 19,577 pounds of water per hour were evaporated from water at 70 degrees Fah. The equivalent from 110 degrees would have been 20,250 pounds. The rate of combustion per square foot of grate surface was 40.7 pounds, and naturally—owing to the air space given to the fire-bars being somewhat wide to obtain this rate of combustion with so low a rate of draught—caused a certain quantity of fuel to be lost; otherwise, bearing in mind the comparatively low temperature of the gases in the funnel, and the consequent complete absorption of the heat by the boiler, the evaporation per pound of coal would have been greater. The weight of refuse taken from the ashpans in a wet state, consisting of ashes and coal fallen through the bars, amounted to nearly 20 per cent. of the total fuel burned. As the ashes contained 10 per cent. of water, the net weight of the ashes and fallen coal in a dry state would have been approximately 19 per cent., and as the coal used only contains ordinarily, if well burnt, from 3 to 4 per cent. of ash, it follows that the loss through the grate bars being wide was approximately 15 per cent., which it is well to note, although this loss, owing to the conditions of working, was unavoidable with low draft. The draft, as shown by draft gauges fixed in the back of the furnace—under the fire-bars and in the fire door opening—showing about 0.25 inches of water. The sight holes—placed in the side of the boiler—indicated the flame to be equally distributed all over the boiler, gradually decreasing in intensity towards the top. The result of this test from the point of view of economy shows that about 72 per cent. of the theoretical calorific value of the fuel (the combustible containing about 15, 150 B. T. U.) could be utilized at the high rate of combustion and evaporation per square foot of heating surface with suitable bars and draft.

Trial No. 2—This was a trial with the same boiler at a lower rate of combustion, and with the improvised heater fixed in the uptake. During two hours trials were made to ascertain at what rate, with the same

TESTS OF BABCOCK & WILCOX WATER TUBE BOILERS ON THE BRITISH TORPEDO GUNBOAT SHELDRAKE.

Trials.....	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Admiralty number.....	1	11.	22	24	111.	27	1 V.	V.	V1.
Date, 1897.....	May 14	19	22	24	25	27	28	June 8	8
Heating surface of boiler, square feet.....	2356	2356	2356	2356	2356	2356	2356	2356	2356
Heating surface of heater, square feet.....	63	175	175	175	175	54	54	54	54
Grate surface, square feet.....	63	63	63	63	63	54	54	54	54
Fire bars used—A for Admiralty pattern, C for corrugated pattern.....	A	A	A	A	C	C	C	A	A
Air space between fire bars, inches.....	1/2 full	1/2	1/2	1/2	1/2	1/2	1/2	1/2 bare	1/2 bare
Kind of fuel used.....	Nixon's	Navgn.	Powell	Duffryn's	for the	remain-	ing 7 tests	2	3
Duration of trial, hours.....	3	2	2	3	3	2	5	2	3
Kind of draught—N for natural; I for induced.....	I	N	N	N	N	N	N	N	N
Amount of draught in inches of water in ashpit.....	0.25	0.2	0.1	0.1	0.1	0.2	0.2	0.1	0.3 to 0.4
Average observed gauge pressure—pounds per square inch.....	185	190	200	200	200	200	200	200	200
Average observed temperature of water fed to heater, Fah.....	70	70	70	70	70	70	70	70	70
Average observed temperature of water fed to boiler, Fah.....	70	117.5	114	111	115	70	70	70	70
Pounds of coal fired per hour.....	2564	2000	1650	1320	1260	1200	1216	1290	2280
Pounds of refuse per hour.....	487	260	91	67	75	90	64	194	251
Pounds of combustible per hour.....	2077	1740	1559	1253	1185	1110	1152	1096	2029
Pounds of coal consumed per square foot of grate per hour.....	40.7	31.74	26.19	20.9	20	22.2	22.5	24	42.2
Pounds of water evaporated per hour under actual conditions; feed at 70 degs. Fah.....	19577	16650	15000	12200	11483	11550	12210	11100	18216
Equivalent weight of water evaporated per hour with feed at 110 degs.....	20250	17222	15516	12619	11878	12881	12630	11481	18842
Pounds of water evaporated per square foot of heating surface.....	8.3	70.6	6.36	5.13	4.87	5.3	5.18	4.7	7.7
Pounds of water evaporated per square foot of grate surface.....	310	264	238	193.5	182	232	226	205.5	337
Pounds of water evaporated per pound of coal per hour; (water 70 degs., steam pressure 200 pounds actual observed conditions).....	7.63	8.32	9.09	9.24	9.11	10.45	10.04	8.6	7.99
Pounds of water evaporated per pound of coal per hour; from and at 212 degs.....	9.15	9.96	10.91	11.69	10.94	12.5	12.05	10.32	9.59
Pounds of water evaporated per pound of combustible per hour; (water 70 degs., steam pressure 200 pounds, actual observed conditions).....	9.4	9.56	9.6	9.77	9.69	11.3	10.6	10.1	8.97
Pounds of water evaporated per pound of combustible per hour; from and at 212 degs. Fah.....	11.28	11.47	11.52	11.72	11.6	13.5	12.72	12.12	10.7
Mean temperature of gases in funnel, Fah.....	650°	600°	600°	500°	550°	510°	550°	600°	200°
Mean temperature of gases above the heater, Fah.....	650°	650°	650°	650°	650°	650°	650°	650°	650°
Mean temperature in uptake below, Fah.....	61.5°	67°	73.2°	74.5°	73.4°	84.2°	80.9°	69.3°	64.4°
Efficiency "A".....	72%	73.2%	73.5%	74.8%	74.3%	86.8%	81.2%	77.4%	68.5%
Efficiency "B".....									

N. B.—Efficiency "A" is the percentage of the total heat of coal that was actually transferred to the water, that is, *without* allowing for loss by unconsumed coal dropping through the bars, or ash.

Efficiency "B" is the actual efficiency, allowing 5 per cent. for ash, and making allowance for the coal that fell through the bars unconsumed; that is to say, these figures are established to show the result that would have been obtained on the assumption that the grate bars had been so arranged that no loss of unconsumed fuel took place, but only the loss by the usual percentage of ash or residue in the fuel.

The total heat of combustion of the coal has been taken at 14,000 British thermal units per pound.

The temperature of the gases were taken by noting the melting of pieces of metal, of a known melting point, placed in the funnel and uptake, and not by a pyrometer.

may be increased by means of fans, though the upcast from the stokehold remain open, and for this four 6-foot double inlet fans were supplied, driven by engines 6 1/2 inches by 5 inches, and capable of running up to 600 revolutions per minute. There are two uptakes and two funnels—one common to two boilers—the inside diameter of each funnel being 5 feet, and the height above the gratebars 45 feet.

The boilers were made under a rigorous survey by the Admiralty surveyors, and in accordance with the terms of the contract, one of the four boilers was erected at the constructors' works, and there subjected to tests by the Admiralty authorities to determine its capacity and efficiency. The guarantee to the Admiralty was that one of these boilers, steamed on shore with natural draught, would evaporate 11,000 to 12,000 pounds of water per hour with Welsh coal, and with the feed-water at hot well temperature, 110 degrees Fah. With forced draught, not exceeding 3 inches of water, it was guaranteed to evaporate 18,000 to 19,000 pounds of water per hour from 110 degrees Fah. for two hours continuously. On the test boiler the ordinary draft was that due to a funnel fixed on the top of the boiler, 3 feet 6 inches diameter, and 45 feet high above the fire-bars, corresponding to what the natural draft would be in one of these boilers in ordinary conditions of working on board ship. The assisted draught was obtained by a steam jet placed in the funnel, the steam being taken from a 3/4-inch pipe, with the outlet reduced to about 1/2-inch diameter. No baffles were used to deflect the flame, or to reduce the area between the tubes.

In the table of tests, those having the Admiralty number were carried out by the Admiralty authorities; the others were made by permission of the Admiralty for the builders' observations. Permission was obtained from the Admiralty to place a feed-heater in the uptake of the tested boiler for experimental purposes, but no heater is placed in the uptakes on board the Sheldrake. It will be observed from the table of tests that this heater was removed after the fifth test.

grate bars as were used on full power trial, it was most economical to work the boiler. The first two hours of the trial, taken up with experiments in this direction, gave no correct results. A further two hours' trial was then made, as given in the table. In this trial the rate of combustion was still above 30 pounds per square foot of grate, and the rate of evaporation 16,650 pounds per hour from 70 degrees Fah., or over 7 pounds per square foot of heating surface of the boiler. The temperature of the water outlet from the improvised heater referred to varied considerably according to the rate of working. It was ascertained, however, that an average of some 40 degrees to 50 degrees Fah. of temperature were added, with a heating surface in the heater of a little over 7 1/4 per cent. of the boiler surface. The temperature in the uptake was below 600 degrees Fah., but notwithstanding, had the heater had more surface, a higher feed temperature would have been obtained. The economy obtained of 8.32 pounds of water evaporated per pound of coal from feed-water at 70 degrees Fah., and the steam pressure at about 190 pounds, is equal to an efficiency of 73.2 per cent. The draft on this trial was two-tenths of an inch, practically only that due to the funnel unassisted.

Trial No. 3—This was a trial to ascertain the rate of economy when working at a still lower rate of combustion than on any of the previous trials, with the improvised heater used on trial No. 2 fixed in the uptakes. Varying rates of firing were also tried. The results of this test of three hours' duration show clearly that, even notwithstanding the reduction in the width of air space between bars, the grate area was too large, in view of the freedom for combustion given by the large furnace space. The bars used were of the firm's corrugated pattern, largely used on stationary boilers with Welsh coal. The efficiency on this trial was 73.5 per cent. of the theoretical value of the coal.

Trial No. 4—This was a trial made with furnace suitable for obtaining the highest economy, but without the heater, which had been previously removed. The furnace was divided into three equal widths by two walls

12 inches high and 9 inches wide, which reduced the grate area to 54 square feet, and with a rate of combustion of 22.5 pounds per square foot of grate per hour. The test was carried on for five hours continuously. The draft was not assisted in any way, but was simply that due to the funnel. As there were practically no ashes falling through into the ash-pans on this trial, the coal was thoroughly burned. The weight of dry ash was equal to about 5 per cent. only, corresponding to that usually found in this class of coal. The mean result of five hours' working was an evaporation of upwards of 10 pounds of water per pound of coal, with feed-water at 70 degrees, the average evaporation being at about 5 pounds per square foot of heating surface. The efficiency is equal to 81 per cent.

Trial No. 5—This trial lasted for two hours, with a slightly smaller evaporation per square foot of heating surface, with the Admiralty type of fire-bars, $\frac{1}{2}$ inch air space, and the heater removed from the uptakes. The results show an efficiency of $77\frac{1}{2}$ per cent. of the theoretical value of the coal. The weight of refuse on the trial was about 15 per cent. of the coal used. The higher efficiency of trial (a) compared to trial (i), both burning about the same amount of coal per square foot of grate surface, is due to the assistance of induced draft in trial (a). Trials (f) and (g) show higher efficiencies than in the other trials, and this was probably due to smaller air spaces between the bars. It is well to mention with regard to the periods for which the water and coal measurements were taken, that whilst the assertion that short tests do not give average results may apply in a general manner, they do not apply in the case of these tests. A boiler holding a relatively small quantity of water answers immediately to the state of the firing, and to maintain the pressure constant and the rate of evaporation constant the firing must be regular. On these tests the fireman was timed to fire a certain quantity of coal through each fire door, the pump was kept going at a uniform speed, and the water level regulated automatically, hence it is clear that under these conditions of testing a short test must give the same results as a long one; naturally on a long test certain loss would be sustained through the necessity to clean fires and heating surface, but by good management this can be brought to a minimum. The facility with which the furnaces can be worked, and the freedom for combustion in the Babcock & Wilcox boilers, renders it possible to run longer without cleaning fires than is usual with ordinary boilers. These tests prove the efficiency of the Babcock & Wilcox marine water-tube boilers, and shows what can be done by careful and intelligent firing. The general efficiency also proved the excellent combustion, the absence of loss from radiation, and the correct disposition of the heating surface. The fuel combustion was so perfect that practically no soot was formed, and no unburnt gases were left to flame in the uptake or chimney. The Admiralty officials expressed themselves highly pleased with the results of the trials.

Trial No. 6—This was a full power trial, under the same conditions as No. 5, except that it was of three hours' duration. The results show that with an air pressure of three-tenths for the first hour, and four-tenths for the second and third hours, the evaporation was equal to 18,216 pounds per hour of water, with feed temperature at 70 degrees. The equivalent from 110 degrees Fah. would have been 18,842 pounds. As the rate of combustion per square foot of grate surface was 42 pounds and the weight of dry refuse at the end of the test was 754 pounds, which equals 11 per cent. of the total coal burned, the loss is equal to 7 per cent. Although worked at such high rate of combustion, the efficiency comes out at 69 per cent. of the theoretical value of the coal.

The notes up to now have been confined to the Admiralty official trials, Nos. 1 to 6, giving the objects in view and the results. Taking the general results of the whole series from (a) to (i), there are one or two interesting points to note. In the first five trials it will be observed that the efficiency of 74.3 per cent. (e), with an evaporation at the rate of 4.87 pounds per square foot of heating surface, only falls to 72 per cent. (a), with an evaporation of 8.3 pounds per square foot of heating surface, and noting the intermediate trials (b), (c) and (d) it shows that the efficiency, when evaporating up to 7 pounds of water per square foot of heating surface, is practically constant, and only above 7 pounds does the efficiency begin to fall. This proves the great elasticity in the working of the Babcock & Wilcox boiler—a result that could not possibly be obtained with the ordinary shell boiler; in other words, the amount of steam formed can vary between considerable limits without any fall in efficiency. Tests (g) and (d), the one with an evaporation of 5.18 and the other 5.13 pounds per square foot of heating surface, give efficiencies of 81 per cent and 74.8 per cent, the higher efficiency of the former being due to the smaller air space between the bars. With this boiler the highest efficiency with natural draught was obtained burning about 22 pounds of coal per square foot of grate surface and $\frac{1}{8}$ inch air space between the bars.

The project for the construction of a ship canal across Cape Cod, between Barnstable and Buzzard's Bay, Mass., appears to have assumed definite shape. The company which is likely to be selected from a number of petitioners to carry out the work proposes to utilize a mile and a third of the canal which has already been constructed, and it is estimated that the remaining six miles can be completed within two years.

A. A. Schantz, general passenger agent of the Detroit & Cleveland Navigation Co., has issued another handsome pictorial card, this time to announce the opening of the Lake Huron division for regular service. Vessels of the Lake Huron division have begun running, twice a week, between Toledo, Detroit and Mackinac, and Sunday trips have been resumed between Detroit and Cleveland.

William L. Guillaudeu, for several years past vice president and traffic manager of the Old Dominion Steamship Co., has been chosen to succeed the late Capt. Bourne as president. Mr. Guillaudeu was the natural selection for the office and his election gives general satisfaction. George E. Weed was elected director to fill Capt. Bourne's unexpired term.



W. J. CONNERS, CONTRACTOR.

Central figure in the struggle with grain shovellers and other dock labor that has been going on at Buffalo.

CAPT. MAHAN AT THE PEACE CONFERENCE.

No man could better represent the naval and maritime interests of the nation on the American commission to the czar's peace conference at The Hague than Capt. Alfred T. Mahan, well known as a writer and foremost student of naval affairs and most recently brought into prominence by his connection with the board of strategy during the Spanish-American war. The fact that Capt. Mahan continually urged upon this country the need of acquiring a strong navy together with broad preparations for war, is not an element of inconsistency in connection with his appointment to the conference as the great naval strategist advocated these things solely in the belief that they contribute in themselves the most potent influence for peace. Moreover, Capt. Mahan possesses the advantage of a special qualification—technical knowledge. He spent thirty years in slowly and steadily attaining rank and influence in the United States navy, and all the while he was a careful, conscientious student. His position had much to do with the fame which he attained throughout the world after the publication of his first book in 1890, as the greatest living exponent of the philosophy of sea power. Capt. Mahan was twenty-nine years of age when he graduated from the naval academy in 1859. When the civil war broke out he returned from duty in Brazilian waters and served successively on the Congress, Pocahontas, Seminole and James Adger. A diversity of work in the navy made him familiar with every phase of the science. His duties embraced the position of instructor at the naval academy, shore duty at the New York and Boston navy yards and sea service in the gulf and Asiatic fleets and on the Pacific station. In addition he presided over the naval war college and was engaged in special duty for the bureau of navigation, finally being retired at his own request in 1896.

Capt. Mahan's fame rests, of course, upon his literary work, to undertake which he retired from the navy. He had at first the invariable difficulty of the author in finding a publisher, but immediately upon the appearance of his first book, "The Influence of Sea Power Upon History," success was assured to him. Most enthusiastic receptions were accorded the volumes which followed, including "The Influence of Sea Power Upon the French Revolution and Empire," "The Life of Nelson, the Embodiment of the Sea Power of Great Britain," and "The Interest of America in Sea Power, Present and Future." All these volumes are published by Little, Brown & Co. of Boston. The works have been translated into French, German and Japanese, and the American publishers alone have sold more than 50,000 copies. Degrees have been conferred upon the author by Oxford and Cambridge and he was made an LL. D. by both Harvard and Yale.

The Marietta Boiler Works of Marietta, O., has brought suit for \$3,700 against the river steamer City of Pittsburg. The sum is said to be due on contract, while the owners withhold payment alleging that the boilers are not working properly. A recent attempt to serve attachment papers on the vessel failed because the claim was set up that being on her trial trip only she was merely subject to the statutes of Ohio and not the maritime laws of the United States.

It is announced that the names Hibernia and Orcania will be given to the two new twin-screw passenger steamers building abroad for the Cunard line. One of them will be completed about the close of the year.

TRADE NOTES.

Two steamers and six sailing vessels have been chartered to transport the balance of a 35,000 ton order for steel rails from the works of the Maryland Steel Co., Sparrow's Point, Md., to Melbourne, Australia.

The Ingersoll-Sergeant Drill Co. of Easton, Pa., has purchased five acres of land adjoining its present property, on which it is proposed to erect additions which will about double the present capacity of the plant.

A contract for furnishing and erecting the structural steel work, consisting of beams, girders, roof trusses and other material, for the New Britain institute, New Britain, Conn., has been secured by the Berlin Iron Bridge Co. of East Berlin, Conn.

The George F. Blake Manufacturing Co., New York, has just issued a special 1899 catalogue of air compressing machinery, which will prove of especial value to all persons interested in the subject, for the reason that all the various types of compressors manufactured by the firm are described minutely.

The Harrison Safety Boiler Works of Philadelphia have completed and sent to the Brooklyn navy yard for shipment to the navy yard at Cavite three separators for the engines of the cruisers Isla de Luzon, Don Juan de Austria and Isla de Cuba, the vessels raised in Manila bay under the direction of Admiral Dewey.

Foreign business of the Q. & C. Co. of Chicago continues very heavy. Shipments of pneumatic tools to the amount of more than \$5,000 have recently been made to Graham Bros., Stockholm, Sweden; Paul Hug & Co., Paris; Laing, Wharton & Down, Bond street, London; and Paul Breckel, St. Petersburg, Russia.

A circular recently issued by the Goulds Mfg. Co. of Seneca Falls, N. Y., deals with a special design of diaphragm suction pump. These pumps are particularly adapted for pumping water containing mud, sand, gravel, sewage, coal, chips or any semi-fluid matter. The pumps with bottom suction (they are also made with side suction and a different kind of valve) are used in places where they remain stationary, as on vessels, barges, dredges, wharves, etc. The lever is reversible and can be used at the back of the pump or on either side. The lower valve is of metal, rubber faced, easy of access and readily removable. The waterways are large and easy, and the diaphragm, which in these pumps takes the place of the plunger, is made of the best quality rubber. A pump of this kind of 12½ inches diameter of diaphragm, 3-inch suction pipe and 2,500 to 3,500 gallons capacity per hour sells for \$20.

The annual reception and oyster roast tendered by the Berlin Iron Bridge Co. of East Berlin Conn., to its employees, has come to be as regular an event as the annual meeting of the stockholders of the concern, and certainly it is far more eagerly anticipated in the whole section of the state in which Berlin is located. About 2,500 invitations were issued to the roast which the company held a few days ago, and more than 4,000 persons were in attendance. The new shop, only recently erected, was transformed into a vast dining room, while the template department had been cleared and turned into a ball room, where hundreds of the young people danced to the music furnished by the Berlin Iron Bridge Co. band. Over 150 bushels of oysters barely sufficed to gratify the appetites of the diners. The entire works were thrown open for the inspection of visitors. Over 400 men are employed by this company, and \$750,000 worth of contracts have been secured so far this year.



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IT IS THE ONLY OPEN LINK ON THE MARKET THAT IS
DROP FORGED FROM BAR STEEL.
For STRENGTH, DURABILITY and SIMPLICITY
IT STANDS WITHOUT A RIVAL

Sizes from ¼ in. to ¾ in.

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STANDARD Wrenches, Hoist Hooks, Eye Bolts, Shafting Collars, Machine Handles, Thumb Nuts, Thumb Screws, Rope sockets and Swivels, Fence Ornaments, Bicycle Forgings, &c.

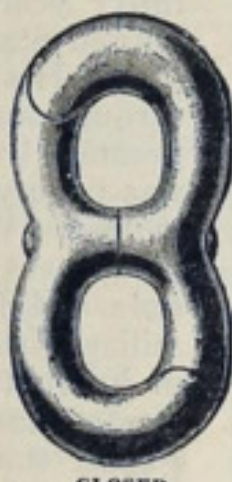
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SHIP REPAIRS AT MANITOWOC, WIS.

THE GOODRICH TRANSPORTATION CO.

Is prepared to undertake all kinds of Repairs to Machinery; also Joiner Work. Repair works include complete Carpenter and Joiner Shop; New Modern Machine Shop, Blacksmith Shop, with Steam Hammer, Punch and Shears, Etc.; Brass Foundry.

These Shops are adjacent to the Dry Dock, and are equipped with best modern machinery—Portable Electric Drills, Complete Electric Power Plant for supplying Motors on board ships, and for lighting. Night work a specialty. All work in charge of skilled mechanics. Charges moderate.

Twenty one feet of water alongside Shops.

Wanted to Charter.

STEAM BARGE of about 175 feet keel, 28 feet beam and 12 feet hold; to carry CIRCUS on lakes during 75 to 100 days
Address F. B. HIGGIE, No. Franklin Street, Chicago. May 18.

IMPROVEMENTS AT THE ROACH SHIP YARD.

Improvements in the Roach ship yard at Chester, Pa., are being carried forward as actively as possible. A new stone foundation for building heavy engines is being constructed in the machine shop and will replace a foundation which was by no means strong enough for the class of work now handled at the yard. The foundation is also in process of construction for the new steam hammer—the third of its type—to be erected in the blacksmith shop. An improved shaper will also be added to the equipment of the machine shop. Work on the Old Dominion liner Jefferson is progressing in a most satisfactory manner. It will be five weeks before her sister ship, the Hamilton, which was launched some time ago will be ready to leave the yard. The Almy water tube boilers for the various steam yachts building at the yard are on hand and the work of installation has begun. Frames are in position for the steamer to replace the ill-fated Portland, while extensive repairs are being made to the steamer Saltram.

WARNING TO VESSEL MASTERS.

The following self-explanatory notice has just been issued by Major Clinton B. Sears, United States engineer in charge of improvements on Lake Superior:

"During the next two years dredging and pier building will be going on in the Duluth ship-canal entrance to the Duluth-Superior harbor. Under section 4 of the act of congress of August 18, 1894, all vessels, until further notice, are required to slow down to six miles an hour when within 500 feet of either entrance of the ship-canal and not to exceed that speed from that point until they have passed 500 feet beyond the other entrance; this irrespective of whether a red flag or lantern be shown, or not. Violation of this rule is a misdemeanor, punishable by a fine not to exceed \$500, or by imprisonment not to exceed six months. Vessel masters are also specially enjoined to exercise great care in passing through the canal that they do not come in collision with dredges, scows, or mooring piles, or the false work to the new piers."

"As showing the steadily increasing demand for pneumatic tools in this country," said one of the officers of the Chicago Pneumatic Tool Co. on Monday last, "we have to-day received by mail at this office orders for eighty-one hammers and riveters, fifty-seven drills of different sizes and seventeen sundry tools, making a total of 155 orders for the day." Mr. Sidney H. Wheelhouse, formerly of the M. M. Buck Mfg. Co. of St. Louis, is now connected with the Chicago company as southwestern agent, with salesroom and office at 409 N. Fourth street, St. Louis.

One fare for the round trip.—The National Baptist Anniversaries will be held at San Francisco, Cal., May 26 to 30. Agents of the Nickel Plate road are in possession of complete information in regard to rates, dates of sale, routes, and time of trains, and will be glad to furnish some to all contemplating a trip to the coast at low rates. 24, May 11.

JAMES MCKAY & CO.

Manufacturers of all kinds of

High Grade Boom, Rafting, **IRON CHAINS.**
Toggle, Marine and Swedish



REMOVAL NOTICE!

MAY 1st

MANNING, MAXWELL & MOORE,

THE CONSOLIDATED SAFETY VALVE CO.

Nickel Seated "Pop" Safety Valves, Locomotive Safety Valves, Water Relief Valves.

THE SHAW ELECTRIC CRANE CO.

Shaw (3) Motor Electric Traveling Cranes.

THE HAYDEN & DERBY CO.

Metropolitan Injectors, H-D Ejectors.

THE PEDRICK & AYER CO.

Special Railway and Machinists' Tools, Air Compressors, Air Hoists, Riveters, etc.

THE ASHCROFT MFG. CO.

Steam and Vacuum Gauges, Edison Recording Gauges, Tabor Indicators, Mossacrop Recorders, Pipe Fitters' Tools.

Have Removed New York Office and Salesrooms
From 111-113 Liberty Street,

To 85, 87, 89 Liberty St., CORNER
BROADWAY,
NEW YORK.

CHICAGO OFFICE:
22-24-26 So. Canal Street.

PITTSBURGH OFFICE:
Park Building.

CLEVELAND OFFICE:
26 South Water Street.

SAULT RIVER LIGHTS.

Although it was expected by officials of the Lake Carriers' Association that most of the private lights in the St. Mary's river would be displaced this season by gas buoys, range lights or fixed lights on cribs or clusters of stone established by the light-house officials, the vessel interests will again be called upon to pay quite a sum for lighting parts of the river. Commander Kennedy's work in the river has been greatly delayed, on account of the lack of facilities, but it is understood that the officials at Washington will give him all possible assistance, and the lighting of the river may be more generally under government control before the season is far advanced. In the meantime the Lake Carriers are trying to make some arrangement whereby the vessel owners will not again be asked to individually contribute to this service at the end of the season. The four keepers of the lights, Leo. Bernard, Joseph Roleau, Arthur D. Raines and Charles Diboll, ask for about \$2,000 in all for their services during the season. An arrangement will probably be made with them to continue the lights already in operation until such time as the government lights are established.

The general assembly of the Presbyterian church holds its annual meeting at Minneapolis, Minn., May 18 to June 1. Agents of the Nickel Plate road are authorized to sell excursion tickets at low rates on May 15, 16 and 17. 28 May 11.

The keel for another steamer to be built for the Plant line was laid at the ship yard of Wm. Cramp & Sons, Philadelphia, on May 2. The steamer La Grande Duchesse, which has finally been accepted by the Plant company, is now at the Cramp yard being refitted and extensive alterations to the steamer Halifax are just being completed. This is in accordance with the policy of the Plant system to maintain all vessels in the very best of condition.

Capt. Harry Pedersen, compass adjuster of Chicago, announces that he may be reached by telephone North 629 or by mail through the Fullerton avenue pumping station.

At the annual meeting of the Atlantic Transport Co. in Baltimore, a few days ago, officers were re-elected as follows: B. N. Baker, president; James S. Whiteley, vice president; C. G. Helm, treasurer; and Waldo Newcomer, secretary.

A visit to the national capital may be enjoyed without extra cost for fare in going to Philadelphia and New York over Pennsylvania short lines. Tickets to those points via Washington may be obtained at same fares as apply over Pennsylvania direct lines, and will be good for ten days' sojourn at the national capital. For particular information apply to Pennsylvania lines ticket agents or address C. L. Kimball, assistant general passenger agent, Cleveland.

A SPECIALTY:

TOWING
AND
SHIPS'
HAWSERS
LINES

ROPE

THE AMERICAN MANUFACTURING CO.

67 WALL STREET, NEW YORK.

THE LARGEST MANUFACTURERS OF FIBER IN THE WORLD.

A SPECIALTY:

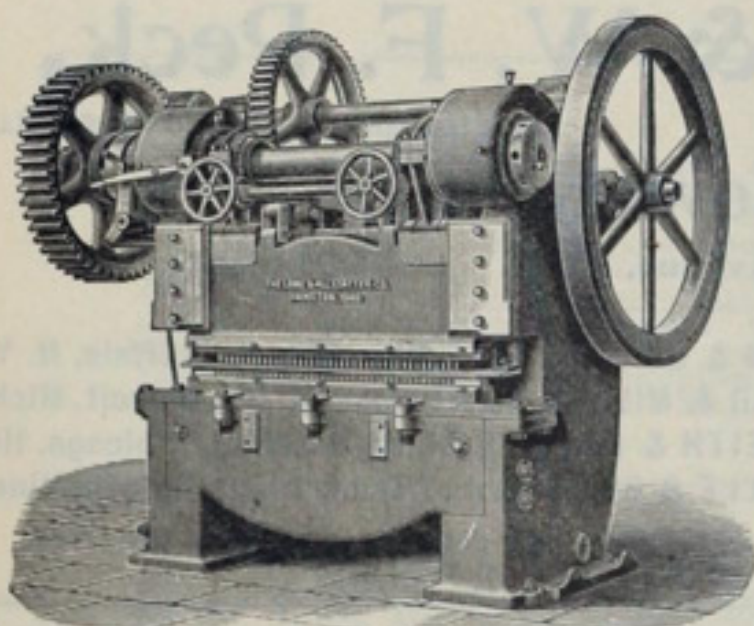
4-STRAND
PLUMBAGO
HEART
HOISTING
ROPE
FOR
CARGO FALLS



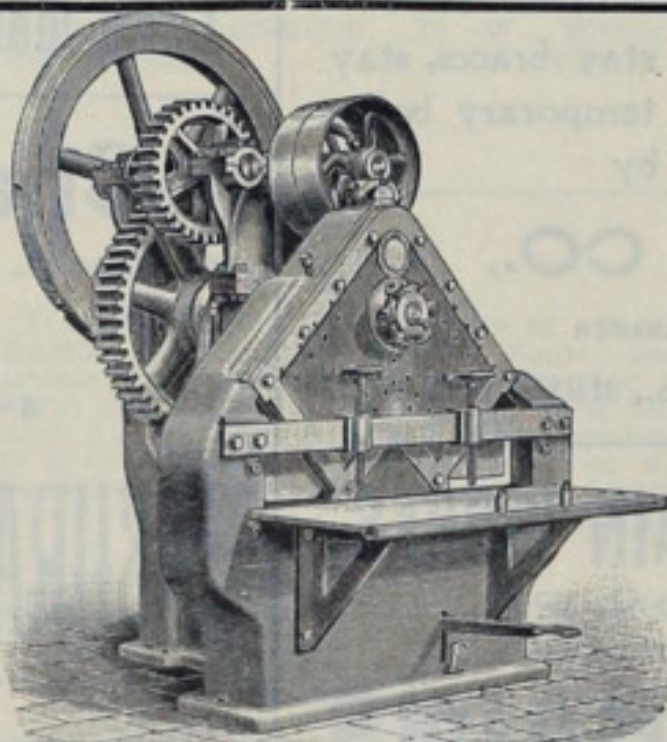
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FOR RIVETING · CHIPPING
CALKING · BEADING FLUES
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LABOR SAVING.....

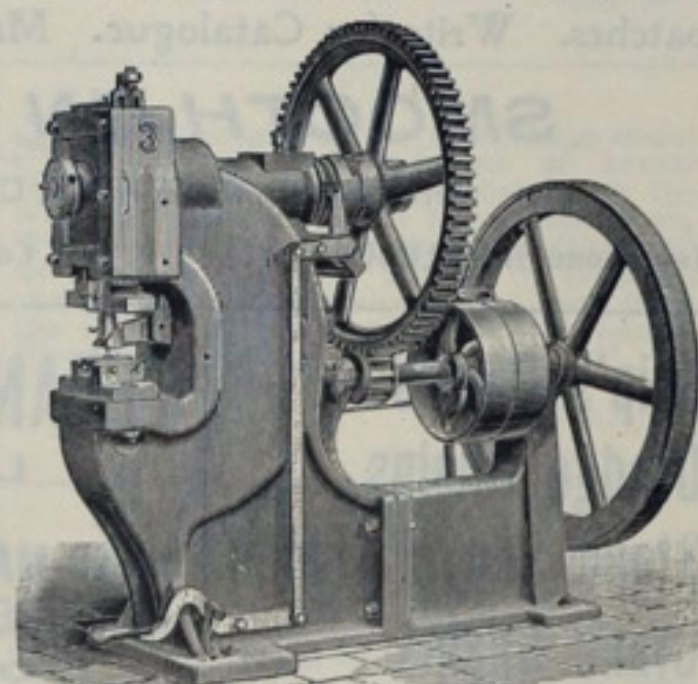


Belt,
Steam
or
Electric
Driven.



POWER SHEARS

Belt,
Steam
or
Electric
Driven.

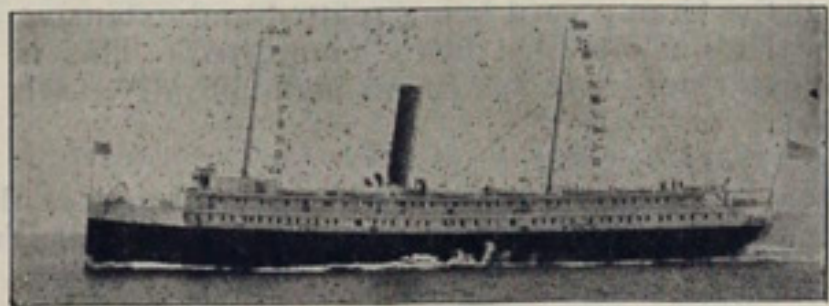


Manufactured by

POWER PUNCHES

The LONG & ALLSTATTER CO. HAMILTON, O.

ROACH'S SHIP YARD.



DELAWARE RIVER
—IRON—
SHIP-BUILDING &
ENGINE WORKS,
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Builders of Steamships and Marine Machinery.

SHIP-BUILDING IN ALL ITS BRANCHES.

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WORKS AT NEWPORT NEWS, VA.
(On Hampton Roads.)

Equipped with a Simpson's Basin Dry Dock capable of docking a vessel 600 feet long, drawing 25 feet of water, at any stage of the tide. Repairs made promptly and at reasonable rates.

SHIP AND ENGINE BUILDERS.

For estimates and further particulars, address

C. B. ORCUTT, Pres't,
No. 1 Broadway. New York.

The Pusey & Jones Company,
WILMINGTON, DELAWARE.

Builders of IRON AND STEEL STEAMERS, STEAM YACHTS,
TOW BOATS, MARINE ENGINES, BOILERS, TANKS,
AND OF HEAVY MACHINERY GENERALLY.

ALSO COPPERSMITH WORK.

SPECIAL FACILITIES for REPAIRS to both WOODEN and METAL BOATS.
MARINE RAILWAY. NO WHARFAGE CHARGED.

W. & A. FLETCHER CO.

NORTH RIVER IRON WORKS.

Marine Engines, Boilers, Etc.

Hudson, 12th and 14th Streets, Hoboken, N. J.

Take Ferry from foot of West 14th Street, N. Y.

SMOOTH ON COMPOUND.

FOR MAKING PERMANENT REPAIRS ON BOILERS OR PIPING.

It can be used on all permanent joints, main stay braces, stay screw nuts, and in all repairs, such as applying temporary boiler patches. Write for Catalogue. Manufactured by

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VREELAND TOMPKINS, CHEMIST AND MANAGER

Telephone 81-A BERGEN.

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Ship's Cables
Dredge Chains
Steam Shovel Chains
Crane Chains
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LEBANON CHAIN WORKS,
LEBANON, PA.

MANUFACTURERS OF

HAND-MADE AND
MACHINE-MADE **CHAINS**

OF ALL GRADES.

WE MANUFACTURE OUR OWN IRON.

All our Chains are tested. High Grade Chains a Specialty

THE HARLAN & HOLLINGSWORTH CO., SHIP BUILDERS, DRY DOCKING, REPAIRING AND OUTFITTING.

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SHIP BUILDERS, RICHMOND, VA.
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Building United States Torpedo Boats

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Insurance Company of North America.

CAPITAL, Paid up in Cash, - - \$3,000,000.00
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Are prepared to make rates on all classes of Marine Insurance on the Great Lakes, both CARGOES and HULLS.

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CAPACITY, 2000 TONS.

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GAS AND STEAM

GENERAL OFFICE, ERIE, PA.
SHIPPING DOCKS, ASHTABULA, O.Long Dist. Tel. No. 409.
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VESSELS FUELED

at all hours with OCEAN Coal only, by Steam Lighter
or Car Dump. Electric Light.

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COALS

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PITTSBURGH
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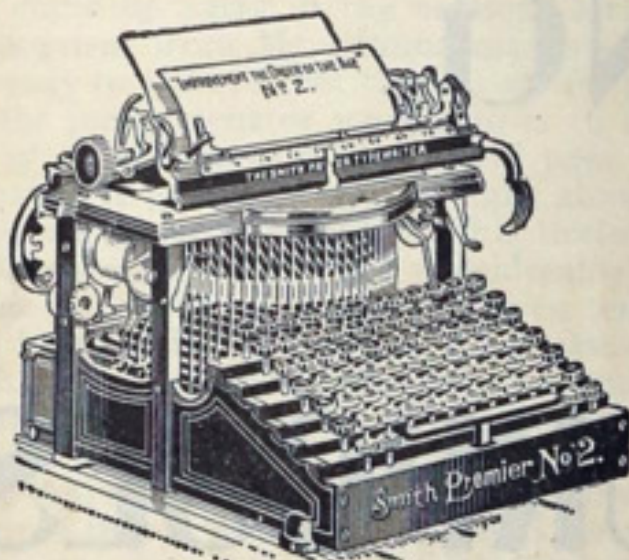
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By STEAM LIGHTER or Car Dump at All
Hours. Electric Light.

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When you buy a Type-
writer that is not built on
accepted scientific princi-
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eat itself up in repair bills
and be a source of con-
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Smith Premier
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is constructed on the best known scientific principles, is of
simple parts, is the most durable machine made and the most
economical to buy.

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348 Superior Street, CLEVELAND, OHIO.



Steamboat Fuel at Ashtabula. LARGE SUPPLIES OF
BEST QUALITY.

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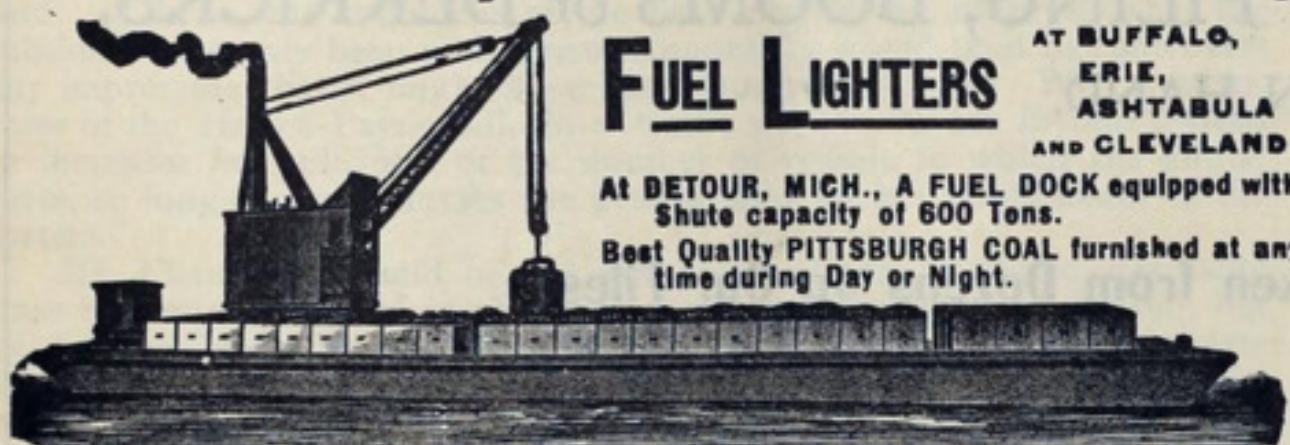
Carrying
Different
Grades
at all
Times.



Fuel scow with elevators
and discharging spouts.
Storage of 650 tons. Dis-
charges 150 tons an hour
into steamers while un-
loading cargo.

M. A. HANNA & CO., Miners and Shippers.
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FUEL LIGHTERS

AT BUFFALO,
ERIE,
ASHTABULA
AND CLEVELAND.

AT DETOUR, MICH., A FUEL DOCK equipped with
Shute capacity of 600 Tons.
Best Quality PITTSBURGH COAL furnished at any
time during Day or Night.

Western Reserve Building, CLEVELAND, O.

U. S. Engineer Office, 57 Park St., Grand
Rapids, Mich., May 10, 1899. Sealed proposals
for repairing Government Piers at Holland,
(Black Lake), Mich., will be received here
until 3 p. m., June 9, 1899, and then publicly
opened. Information furnished on applica-
tion. Chester Harding, Capt., Engrs.
June 1.

U. S. Engineer Office, 185 Euclid Ave.,
Cleveland, O., April 15, 1899. Sealed pro-
posals for dredging channels, and for
constructing jetty and bar protection of
brush and stone at Sandusky Harbor,
Ohio, will be received here until 2
o'clock, p. m., central standard time,
May 15, 1899, and then publicly opened.
Information furnished on application.
Jared A. Smith, Col., Engrs. May 11.

PROPOSALS FOR DREDGES.—Missis-
sippi River Commission, Fullerton Bul-
ding, St. Louis, Mo., April 19, 1899.—Sealed
proposals, in triplicate, for construction
and delivery of two self-propelling hydrau-
lic dredges complete with machinery, cab-
in, outfit, etc., will be received here until 12
o'clock noon, standard time, May 31, 1899,
and then publicly opened. Information
furnished on application. Mason M. Pat-
rick, Capt., Engrs, Sec'y. May 25.

U. S. Engineer Office, D. S. Morgan
Building, Buffalo, N. Y., April 1, 1899.
Sealed proposals for hire of dredging plant
for excavation in Niagara River will be
received here until 11 o'clock a. m., May
20, 1899, and then opened. Information fur-
nished on application. T. W. Symons,
Major, Engrs. May 11.

U. S. Engineer Office, 57 Park St., Grand
Rapids, Mich., April 19, 1899. Sealed pro-
posals for repairing government pier at
Saint Joseph, Mich., will be received here
until 3 p. m., May 19, 1899, and then public-
ly opened. Information furnished on ap-
plication. Chester Harding, Capt., Engrs.
May 11.

U. S. Engineer Office, Milwaukee, Wis.,
April 10, 1899. Sealed proposals for dredg-
ing at: Menominee River, Oconto, Green
Bay, Two Rivers, and Milwaukee harbors,
will be received here until 12 o'clock noon,
standard time, May 17, 1899, and then public-
ly opened. Information furnished on
application. J. G. Warren, Capt., Engrs.
May 11.

U. S. Engineer Office, Milwaukee, Wis.,
April 20, 1899. Sealed proposals for Har-
bor of Refuge Milwaukee Bay, Wis.,
breakwater construction; Racine Harbor,
Wis., crib pier, breakwater, removal of old
pier, and dredging; Kenosha Harbor,
Wis., pile and crib piers, crib breakwater,
removal of old pier, and dredging; will
be received here until 12 o'clock noon,
standard time, May 25, 1899, and then pub-
licly opened. Information furnished on
application. J. G. Warren, Capt., Engrs.
May 18.

SEALED proposals for furnishing about
twenty-four thousand tons of armor
for naval vessels will be received at the
Navy Department until 12 o'clock, noon,
Wednesday, May 31, 1899, when they will
be publicly opened. Forms of proposal
and all information may be obtained from
the Chief of the Bureau of Ordnance,
Navy Department, Washington, D. C.
Chas. H. Allen, Acting Secretary.
3-29-99—May 11

U. S. Engineer Office, 1637 Indiana Ave.,
Chicago, Ill., April 25, 1899. Sealed pro-
posals for dredging in Calumet River will
be received until noon (central time) May
25, 1899, and then publicly opened. Infor-
mation furnished on application. W. L.
Marshall, Maj., Engrs. May 18.

White Pine! White Pine! White Pine!

THE ONLY PERFECT WOOD FOR

SPARS, DECKING,

—OR—

OTHER SHIPBUILDING PURPOSES

10,000,000 FEET OF LOGS, } **IN STOCK NOW.**
25,000,000 FEET OF LUMBER, }

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ALWAYS ON HAND.

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